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## CONTRIBUTIONS FROM MEMBERS OF THE AMERICAN UROLOGICAL ASSOCIATION IN MEMORY OF THEIR DECEASED COLLEAGUE PAUL MONROE PILCHER

(OBIIT JANUARY 4, 1917)

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Paul M. Pilcher

# ANNALS *of* SURGERY

VOL. LXV MAY, 1917 No. 5

## A TRIBUTE TO THE MEMORY OF PAUL M. PILCHER

BY DANIEL N. EISENDRATH, M.D.

There is a reaper, whose name is death,
And, with his sickle keen,
He reaps the bearded grain at a breath,
And the flowers that grow between.

ON January the fourth of the present year, the surgical profession of America lost, through death from pneumonia, one of the most promising of its younger members—Dr. Paul M. Pilcher.

Although only forty years of age when he died, his many valuable contributions to surgical and. especially, to urological literature had already served to attract the attention of the entire profession. His genial personality and innate modesty had won for him a rapidly widening circle of friends and admirers.

An untiring, conscientious worker, constantly alive to the necessity of improving our methods of diagnosis and operative technic, he lived to see many of his ideas adopted by the fellow-workers in the special field of urology.

After receiving his academic degree at the University of Michigan and graduating in medicine at the College of Physicians and Surgeons of New York, he spent two years as interne at the Seney Hospital, Brooklyn. He continued his work in the European Clinics of Nitze, von Frisch and other urologists and laid the foundation for his work in this field.

In 1910 he relinquished all other hospital work in order to devote his entire time to the development of the Pilcher Private Hospital, in which he was associated with his father and brother. During a visit to this institution in the spring of 1916, the writer was very much impressed with the organization of this rapidly growing institution and the coöperation of the father and the two sons in utilizing the most advanced methods in the diagnosis and treatment of all varieties of surgical cases. The enthusiasm of Paul Pilcher was contagious, and

his ingenuity in suggesting so many improvements in the technic of urological operations elicited my highest praise and admiration.

His book on cystoscopy is a most conscientious and splendid effort to make this method of diagnosis an open instead of a sealed book to the rank and file of the profession. His restless ambition was evident to all who came in contact with him, especially his efforts to keep pace with the many and rapid advances of our profession.

As a token of respect and of admiration, keenly alive to the loss of a dear friend and esteemed fellow-worker, his colleagues have chosen this method of publishing a series of contributions to serve as a memorial for one who was destined to be a leader in the profession, and the publishers of the ANNALS OF SURGERY have willingly consented that the present, May, issue of that journal should be devoted to these articles.

BY ABR. M. WOLBARST

IT is a great privilege to say a word in commemoration of Paul M. Pilcher. It was a still greater privilege to have known him. I appreciate both privileges, and am better for having had them.

Much may be said of Paul Pilcher as a surgeon; still more, perhaps, as a skilled and progressive urologist. We who knew him, who worked with him, and are still struggling over the same problems as he did, fully realize what a splendid name he made for himself among his colleagues throughout the profession—a name that shall shine among the pioneers of urology.

But to me Paul Pilcher was always more than a good surgeon or a fine urologist. I know other good surgeons, fine urologists. But Pilcher was more than either of these. He was a man of rare personality; vigorous, but never aggressive; strong, but never domineering; modest, yet certain of himself. Even when he opposed you, he did it as you would like to have it done; you respected his opposition. When he was near, one always felt a sense of good will and good fellowship. He carried an atmosphere of good feeling and kindness about him. He was a man in every fibre of his being—a man's man, a man whom men could admire, and did admire, not only for what he did but for what he was. In a word, Paul Pilcher made friends and kept them by force of that great and rare attainment—he was a gentleman. What better can be said of any man?

*Brevis a naturâ nobis vita data est; at memoria bene reditæ vitæ sempiterna.*

## TRIBUTE FROM THE AMERICAN UROLOGICAL SOCIETY

IN MEMORIAM: DR. PAUL M. PILCHER

THE sudden and untimely death of Dr. Paul M. Pilcher was a great loss to the American Urological Association. He had long been an active participant in the scientific programs of the annual meetings, always presenting something of practical value to the members. His brilliant scientific work and valuable deductions will always rank prominently among those of his contemporaries. His affable manner, his genial nature and his charming personality endeared him to all who knew him.

Therefore, *be it resolved,* that The American Urological Association in annual session in Chicago the fourth day of April, nineteen hundred seventeen, hereby formally recognizes its irreparable loss in the death of Dr. Paul M. Pilcher, and extends its most sincere sympathy to the bereaved family.

*Committee,* E. O. SMITH,
CARL LEWIS WHEELER,
HOMER G. HAMER.

## MEMORIAL TRIBUTE TO PAUL MONROE PILCHER, A.M., M.D.*

ON January fourth of this year, Paul Monroe Pilcher died at the age of forty, and with his death this Society sustained the loss of one of its most active and enthusiastic members.

"Life is not measured by the time we live," but to few, indeed, is given the privilege to live so well and accomplish so much in the brief space of time allotted to our late friend and fellow worker. If we, his friends, believing with a profound faith in divine omniscience that all things are for the best, should wonder why such a man should be taken from our midst in the very zenith of his activity and power and influence, we may, perhaps, find some comfort in the thought that that inscrutable Providence which controls our destinies and shapes our ends recognized in the life of Paul Pilcher a life that was already rounded out and complete.

It seems almost superfluous to pronounce a eulogy upon Doctor Pilcher before this body. His life and work were familiar to all of us. Inheriting as he did a talent for surgery, he supplemented those qualities with which Nature had so bountifully endowed him, with a tireless

* Read at the meeting of the New York Urological Society, April 11, 1917.

energy and an infinite capacity for work for the purpose of developing that branch of our profession and more particularly that department of surgery which this Society represents.

Born in Brooklyn on April 11, 1876, his preliminary education was received at the Polytechnic Institute of that city and later at the University of Michigan, from which latter institution he graduated in 1898 with the degree of Bachelor of Arts. His medical education was obtained in this city and he received his M.D. from the College of Physicians and Surgeons in 1900. In the same year Columbia University conferred upon him the degree of Master of Arts. Following his graduation he spent the next two years on the resident staff of the Seney Hospital where his father, Doctor L. S. Pilcher, was at that time senior surgeon. Having completed his hospital course he supplemented his post-graduate study by a year in Europe working under such masters as Koenig, Orth, Nitze, Von Nisch, and others. His time was devoted entirely to the study of surgical pathology and modern urology. At that time urology was passing through a transitional period. Wonderful strides were being made in the development of more accurate measures of diagnosis and treatment. Doctor Pilcher availed himself of all these exceptional opportunities and here laid the foundation of his work which he so nobly carried forward upon his return to Brooklyn.

From the beginning his efforts were limited to surgery, and his merits and attainments soon won for him appointments on the surgical staffs of the Seney, German, St. John's, and the Jewish Hospitals. His duties at these institutions were discharged with credit, and already young Pilcher was marked as one of the coming men of Brooklyn. Early in his career, however, he resigned from these honored positions that he might devote his entire time and energies to the development of the Pilcher Private Hospital which had recently been started by his father and himself. Here he concentrated his efforts upon the surgical diseases of the kidney, bladder, and ureter. This comparatively small hospital became at once a model for completeness. No appliance that might in any way facilitate the diagnosis and treatment of urinary pathology was missing, and as new developments appeared they were added. Every patient, rich and poor alike, was examined and treated with infinite care and painstaking attention to detail. We of Brooklyn were proud of Doctor Pilcher and the work he was doing in his clinic. It reflected credit upon the profession in our borough.

The news of such work could not be long confined to local boundaries, and the Pilcher Clinic soon attained a national and international reputation. His contributions to urological literature were numerous

and valuable. One has but to mention his work on renal tuberculosis, renal varix, and prostatic hypertrophy, all well known to members of the Society, to illustrate the character of his contributions. He found time in the midst of his many duties to edit the *Long Island Medical Journal,* from 1907 to 1911. In 1911 he published his work, " Practical Cystoscopy," which will stand for many years as a monument to his life and ability. More recently he edited a translation of the clinical lectures of Professor Rovsing of Denmark. In addition to being secretary of this body at the time of his death, Doctor Pilcher was a member of the executive committee of our parent Society. He was Chairman of the Section in Surgery of the New York State Medical Society, and only a few months ago was elected to membership in that most exclusive of all surgical bodies in this country, the American Surgical Association. He took an active part in the deliberations of all these societies, he was eloquent in debate, and his contributions were looked upon as authoritative.

Such, briefly, was the life and work of Paul Pilcher—" Fame comes only when deserved, and then is as inevitable as destiny, for it is destiny."

It is perhaps fitting and proper that a Brooklyn member of the Society should voice these final sentiments of appreciation and respect for our late fellow member, for those of us, his neighbors, who knew him intimately came to know that, preëminent as were his professional attainments, his qualities as a man and friend were equally commendable and noteworthy.

I regret that an abler pen than mine could not have more adequately expressed our appreciation of the character of one of our most distinguished members. He was honored by his profession, he was revered by his patients, he was loved by his friends. This is perhaps small consolation to those who were near and dear to him, but it should serve in a measure to assuage their grief, for such a reward can only come to a noble life, nobly spent.

NATHANIEL P. RATHBUN.

# KIDNEY WITH DOUBLE PELVIS AND DOUBLE URETER: NEPHROLITHIASIS: PYONEPHROSIS: NEPHRECTOMY

By Lewis Stephen Pilcher, M.D.

of Brooklyn, New York

To the case which is the subject of the following report especial interest attaches, both on account of the anatomical abnormality of which it was the subject, and, more especially, for the reason that it was the last case operated upon by Dr. Paul M. Pilcher before the development of the pneumonia which caused his death. Indeed, at the time of undertaking this operation he was already manifesting the depression premonitory of this disease, and it was only by summoning all his reserved force that he was able to carry it through, and he went from the operating room to his bed. He had, however, promised to operate for the relief of this patient upon the day set, and the patient, on account of his sufferings, was impatient and insistent that it be not deferred. Influenced, therefore, by his professional ardor and by his desire to comply with the promise that he had made to this man, he proceeded with his work. In another aspect this case further illustrates the spirit peculiar to surgeons as a class, inasmuch as for his work in the care of this patient he was not to receive any money reward. It was a charity patient.

The man was forty-one years of age. For four years he had been suffering from intermittent attacks of pain in the right side. For six months previous to admission there had been blood in the urine every day; previous to that time it had been perfectly clear. He had no pain in the bladder. Had to empty his bladder during the day every three hours, and during the night once or twice. When blood was not present in the urine there was a creamy sediment.

Upon *cystoscopic examination,* the bladder contained a normal amount of fluid; no cystitis present; the left ureter opening was normal in appearance and function; catheter entered the left ureter without any obstruction and advanced without trouble. The urine dropped from the catheter in the left ureter in a normal manner. The right ureter opening was swollen and surrounded by small flakes of pus; the catheter entered without disturbance, but caused pain after going up about 10 centimetres. The urine

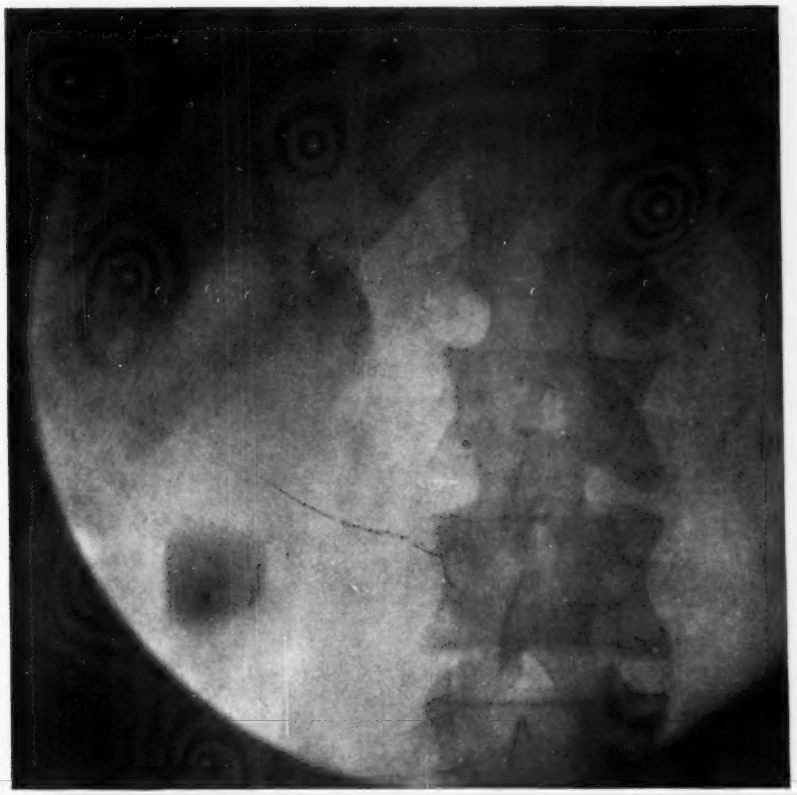

FIG. 1.—Double kidney with pelvis and ureter for each portion, each portion the subject of pyonephrosis. Large calculus in lower sac. Skiagraph before operation. See Figs. 2 and 3. Note the shadow cast by the normal kidney tissue at the upper pole. Note the shadow of the calculus in the lower pole.

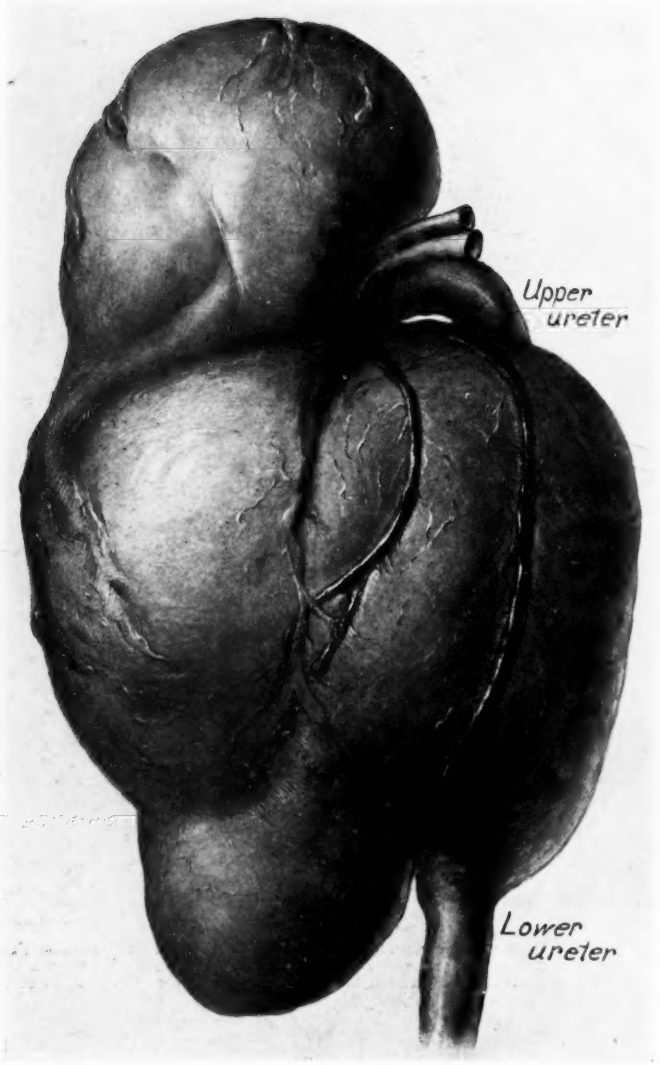


FIG. 2.—Double kidney with pelvis and ureter for each portion, each portion the subject of pyonephrosis. Large calculus in lower sac. External appearance at time of removal.

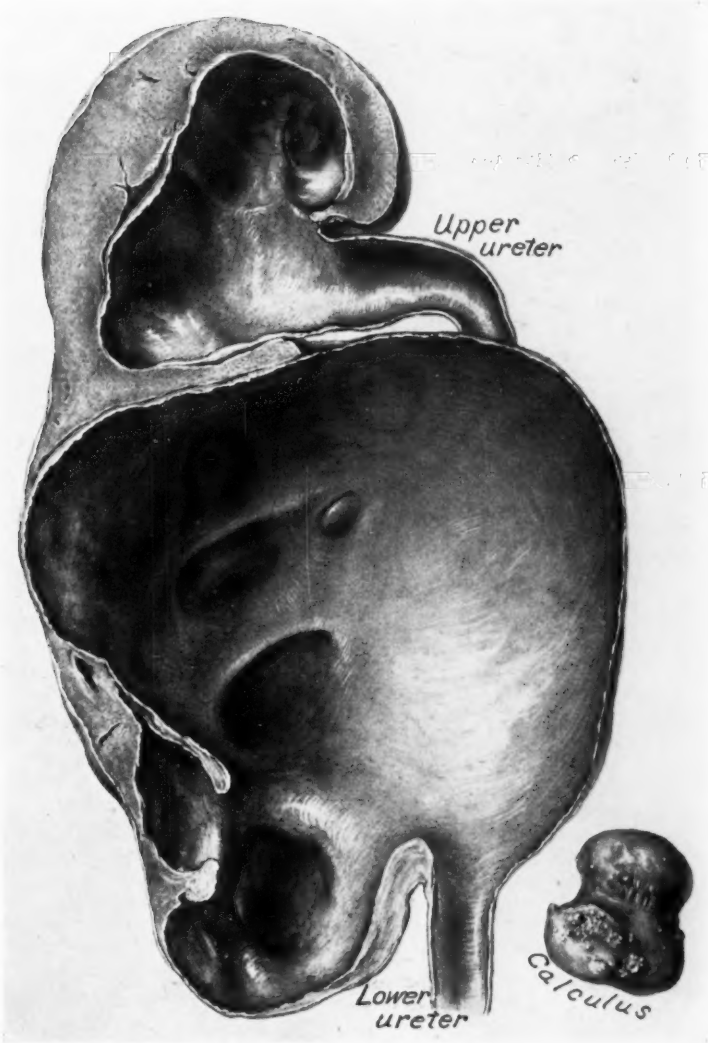


FIG. 3.—Double kidney with pelvis and ureter for each portion, each portion the subject of pyonephrosis. Large calculus in lower sac. Sagittal section.

from this catheter dropped rapidly and continuously, showing fluid accumulated in a dilatation of the pelvis (pyohydronephrosis).

| Urinalysis | Right Kidney | Left Kidney |
|---|---|---|
| Specific gravity | 1.002 | 1.012 |
| Urea | 0.19 per cent. | 1.35 per cent. |
| Albumin | + + | 0 |
| Pus | + + + + | 0 |
| Round cells | + + | + + + + |
| Casts | 0 | 0 |
| Calcium oxalate | + | 0 |
| Phthalein test, amount passed in 30 min. | 0 | 7 per cent. |
| Quantity urine in 30 min. | 3 c.c. | 14 c.c. |

The X-ray picture (Fig. 1) showed a large stone in the pelvis of the right kidney. In the right kidney region there were irregular areas of density the exact nature of which could not be known. The lack of function after the injection of phthalein with the urinary specific gravity of 1.002, with the large amount of pus, with the urea only 0.19 per cent., and the fact that the left kidney was secreting the normal amount of urine indicated that the right kidney was largely destroyed. Its removal with its contained calculus was therefore advised.

*Operation: Nephrectomy.*—December 27, 1916. Under ether anæsthesia the right kidney was exposed by the usual lumbar incision. It was greatly enlarged, the enlargement being due to a distention of the pelvis of the kidney, including the first portion of the ureter and the lower portion of the kidney. There was evidently a pyonephrosis and a hydro-ureter. Over the greatly dilated pelvis of the kidney large vessels could be seen coursing (see Fig. 2). These were divided and stripped back toward the pedicle at the base. By dividing these vessels the mobility of the kidney was greatly increased, and it was possible to bring it more fully out into the wound. At this time a second ureter, also dilated, was discovered going to the upper pole of the kidney, entirely separate from the first ureter (Figs. 2 and 3). This second ureter was in its normal relations to the vessels entering the hilum of the kidney, as shown in the figure (Fig. 2). The lower ureter which opened into the greater sac which occupied the lower half of the kidney had no vascular relations of importance. The vessels of the pedicle were divided between double ligatures and the kidney was left still attached to the lower ureter, and hung out of the lower angle of the wound. Then the wound cavity was obliterated by a series of buried chromic sutures, with a cigarette drain in place leading up to the deepest

portion of the cavity below the diaphragm, and a second one in the lower angle of the wound along the lower ureter. After the wound had been entirely closed down to the remaining ureter, the ureter was ligated and divided by cautery, permitting the kidney to be removed without the wound having been soiled at any time by the foul contents of its cavity. The stump of ureter was fastened into the lower angle of the wound by a point of suture.

The patient bore the operation well and reacted promptly. The whole of the vast wound cavity closed by primary union. The cauterized end of the ureter was thrown off as a slough in due time, leaving a granulating surface. A slight separating of the adjacent wound edges also healed by granulation.

Section of the kidney after removal showed there to be two large sacs present (Fig. 3), entirely independent of each other, the larger sac being the lower one, and each having its own ureter. In the lower and larger sac there was a large uric acid calculus. There was very little kidney secreting tissue left in the walls of this sac. The upper half of the kidney contained a sac of similar character, as is shown well in the accompanying cut; but a much larger amount of sound kidney tissue remained in its walls. Its sac communicated with a second ureter, as had already been noted in the course of the operation. It contained no calculus.

In the course of the operative dissection the further course of the two ureters was not followed so as to demonstrate their relations. The upper one was included in the vascular pedicle that was ligated and divided. The lower one was secured in the lower angle of the wound as described. Only one right ureteral opening in the bladder was seen at the time of the cystoscopic examination. The history shows that attempts to pass a catheter into the right ureter met with obstruction after passing upwards about 10 centimetres (four inches). The natural inference is that the point of obstruction was caused by the branching of the ureter at this point. The literature of double ureters sustains the possibilities of such an arrangement.

### Note by Daniel W. Eisendrath, M.D.

In a recent article upon the double kidney, Young and Davis[1] report a case in which the upper half of a double kidney was removed for a hydronephrosis with a large calculus. In addition to this case

[1] Journal of Urology, 1917, i, 17.

and one reported by Young,[2] in 1903, they were able to collect twenty-four instances in which this form of anomalous kidney was operated upon. Dr. Pilcher's case and two reported by Eisendrath [3] and Israel [4] make a total of thirty published operations on double kidneys.

The article of Drs. Young and Davis is so complete that it will be freely quoted. All of the cases operated upon showed complete duplication of the renal pelvis and grades of ureteral duplication varying from a bifurcation close to the kidney to a complete supernumerary ureter with a separate vesical orifice. All but two cases were operated upon because of a pathological process in the anomalous kidney, and in all but three the remaining segment was normal at the time of operation. In 19 of 24 cases the pathological condition was located in the upper segment.

In two instances the operation was pyelotomy, in twenty a nephrectomy was done, and in all but one the operation was complete nephrectomy. Sixteen of the double kidneys were half normal and would have afforded an opportunity for partial nephrectomy with preservation of a normal portion according to Young and Davis. Such a conservative procedure can only be carried out, however, when there is a more or less demarcation between the parenchyma of the two halves and if the vessels of the two halves can be separated.

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[2] Monatsb. f. Urol., 1903, 8, 591.
[3] Surgical Clinics of Chicago, April, 1917, 1.
[4] Nierenchirurgie, Berlin, 1901.

# THE PROBLEM OF PROSTATIC OBSTRUCTION

By John H. Cunningham, Jr.
of Boston

Aside from personal feelings at the loss of our friend, Dr. Paul M. Pilcher, the profession and the community are deprived of one whose service has been of singular merit. There is much that he has left in our memory, and when asked to contribute to this memorial number of the Annals of Surgery, one quite naturally chooses to consider the prostatic problem, about which one can recall many pleasant and profitable discussions with him, and with which subject his name will always be associated. The subject matter which follows contains much upon which we have held the same conviction and other features upon which we have argued at length without reaching agreement.

Prostatic obstruction occupies a peculiar place in surgery, inasmuch as the condition is the most common malady of advanced years requiring surgical intervention. Prostatic patients, therefore, represent a group of individuals past the prime of life in whom degenerative changes have taken place in all tissues to some degree, with the possibility of serious impairment of the functions of important organs as a frequent accompaniment to the more prominent features of derangement in the urinary system. The most common and dangerous are respiratory and cardiorenal. The renal changes, often with infection, resulting in serious impairment of function are by far the most important factors influencing the mortality in prostatic operations, yet accompanying impairment of all bodily functions is not without its influence.

The *pre-operative study and preparation of the patient* for radical treatment and the importance of post-operative care are phases of the subject which have been clearly expressed by Dr. Pilcher. His charts, which he has frequently shown, recording the different phases of renal adjustment, dependent upon bladder drainage, prior to removal of the obstructing gland, have done much to establish the value of pre-operative adjustment of the kidneys before undertaking prostatectomy. These charts show what I have proved to be true; that following the establishment of drainage of the bladder harboring a residual urine, either by bladder drainage *à demeure* or by a suprapubic cystotomy, there is a stage of renal depression; expressed by a drop in the

24-hour amount of urine, the blood urea and phthalein output with a gradual rise in the specific gravity of the urine. This stage of depression is also evident in the general condition of the patient. It is the danger period, through which the patient must pass, and it explains most of the deaths occurring within the first four or five days when prostatectomy has been performed without previously producing renal adjustment by the less severe methods of accomplishment—through constant urethral drainage, secured by an indwelling catheter, or suprapubic cystotomy. Even when employing these methods to secure renal readjustment, I have occasionally had deaths occur unexpectedly. Following the few days of depression dependent upon bladder drainage, as evidenced by the clinical picture and chemical tests, there is a gradual improvement in all respects, which remains more or less constant, but naturally varies with different patients according to the degree of impairment of other bodily tissue as well as the renal tissue.

When this state of individual equilibrium is established, and not before, in cases with a large retention, the patient is in condition to undergo investigation to learn the character of the obstruction and whatever changes may be present in the bladder.

The character of the prostatic obstruction varies greatly; it may be malignant, or, if benign, it may be an intra-urethral or intravesical obstruction, a simple prostatic bar, or contracture of the vesical neck, or the gland instead of being of the large hypertrophied type may be small and fibrous. Cystoscopy is an important aid in not only furnishing information in regard to these points, but it makes possible the determination as to whether or not calculi or diverticuli are present, and much may be learned in regard to the condition of the bladder musculature and mucosa; which features are important to know prior to operation. Cystoscopy is not always possible on account of the obstruction and for other reasons. It is well in these cases to have all the knowledge that the Röntgen rays may furnish in regard to calculi and a cysto- or cysto-uretopyelogram may furnish valuable evidence of the condition of the bladder, ureters and kidneys. It is this preoperative study, both local and general, and the employment of preoperative measures to improve the reserve power of the individual patient that is the most important advance which has been made in prostatic surgery during recent years.

*Choice of Treatment.*—It is the information obtained by the employment of these pre-operative features that has led me to the conclusion that there is no one operation applicable to all cases. From the study

of the individual patient two important factors are established: the general condition of the individual and the character of the obstruction to the outflow of urine from the bladder. As a consequence of this knowledge there will be a non-operative and an operative class.

*The Non-operative Class.*—Although relatively small, this class includes (1) those individuals whose general impairment is such that they would not stand the tax of removing the gland, and in whom the character of the obstruction is such that no simpler procedure for relief of the obstruction would be of benefit, and in whom the passage of a catheter is possible—under these circumstances catheter life is preferable to a permanent suprapubic sinus; (2) individuals with carcinoma of the gland without associated benign hypertrophy, in whom regular catheterization is still possible. Prostatic carcinoma rarely has the malignant features of carcinoma elsewhere, and I have had many patients, considered inoperable, go for several years with comparative comfort before it became necessary to establish a permanent suprapubic sinus, while others died of intercurrent diseases. These patients may, moreover, be subjected to whatever benefit radium has to offer; (3) individuals whose general condition is satisfactory, but who have symptoms of prostatism, dependent upon the retention of prostatic secretions and secondary congestion. This class, often having a considerable residual urine with little or no true hypertrophy, need not be subjected to prostatectomy. Emptying of the gland of retained secretions, by massage, at stated intervals, with care in regard to bowel dejections, keeping the urine bland and abstinence from ungratified sexual excitement will result in almost or entire emptying of the bladder; and, while requiring occasional local treatment, the indications are far better met than by operation.

*The Operative Class.*—A clear understanding of the patient's general condition and the type of the prostatic obstruction will have much influence in the choice of the best operative procedure to be employed.

*Operation: Not Radical.*—If the patient's condition is below the standard required for a radical removal of the gland, some less severe method of relief of the bladder retention must be considered. If the obstruction is chiefly intra-urethral and benign in character, the galvano-cautery operation of Bottini, done under local anæsthesia, may offer much in giving a freer outlet by destroying a portion of the obstructing gland. While this operation has fallen more or less into disuse, because of the improvement in the manner of preparation, whereby more patients may be safely subjected to more radical operations on that account, its usefulness is all that it was in the past,

when it was quite generally employed by those skilled in cystoscopy and the manipulation of urethral instruments, and still offers great relief to the properly selected cases which will not stand the more radical procedure of prostatectomy.

Prostatics, in whom the obstruction is due to a bar at the vesical neck, or sclerosis of the vesical sphincter, whether or not the general condition would permit of a prostatectomy, had best be subjected to the so-called " punch operation," a procedure carried out under local anæsthesia with a special instrument which cuts away the obstructing portion of the gland.

Patients, with a benign or a malignant gland, who are unfit to stand a radical operation and who do not possess the type of gland suitable for the Bottini or " punch operation " and for whom regular catheterization cannot be carried out, either because of the obstructive nature of the gland or because of their mentality, financial or social status, may have to submit to the establishment of a permanent suprapubic drainage. Fortunately this class is small, yet the procedure gives much comfort to the remaining existence of the unfortunate individual. By the employment of a device to keep the patient dry, and with bladder irrigations that the most unskilled can carry out, and occasional removal and cleaning of the drainage tube, these patients are relieved of a most distressing condition.

*Radical Operations.*—Here, also, no one operation is suitable for all cases. Circumstances associated with the individual case should have much influence on the choice of operation. At the first meeting with the patient, acute retention may be present and it may be impossible to pass a catheter into the bladder through the urethra to relieve the retention, whereby it will be necessary to do an immediate suprapubic drainage, in which event, the gland had best be removed suprapubically when the adjustment of the kidneys and the patient's general condition will permit. If the passage of a catheter is possible in such patients, it should be fastened in, and constant bladder drainage secured until the desired adjustment has taken place and the type of obstruction learned.

The discussion as to whether a large adenomatous gland shall be removed by the suprapubic or perineal route will depend upon a clear understanding of how much of a tax the individual patient may be subjected to with safety; yet if the obstructing gland is of the small fibrous variety it should be attacked through the perineal route without question.

*Bladder drainage* is the important feature of pre-operative treatment

and is the means to the end of estimating the recuperative power of the individual; if a catheter can be passed to the bladder through the urethra and secured there, nothing more in the way of drainage can be desired in most instances; and this form of bladder drainage has all the advantage and none of the disadvantages of a suprapubic cystotomy established for drainage. Constant drainage having been established, either *per urethra* or suprapubically, the patient is, to all intent and purpose, relieved of his suffering and can recover lost sleep, in which most are in need, fluids may be forced and the bladder irrigated. Phthalein tests and urinalysis can be repeated every few days; the 24-hour amount of urine recorded, and a knowledge of the renal improvement thus obtained. Upon the recuperative power, as evidenced by the general condition and local examination, will depend the ability of the individual to stand the strain of operation.

*Suprapubic prostatectomy,* either by the one- or two-stage technic, carries a higher mortality than the perineal operation, either by the dissecting or median urethra enucleation methods. The actual advantage of the suprapubic over the perineal route is that a relatively more satisfactory result may be expected.

The whole subject of suprapubic and perineal operations may be summarized, I believe, in the fact that suprapubic prostatectomy carries a relatively higher mortality with a better average functional result. This well-established fact should lead to subjecting only the best risks to the suprapubic operation. Those not coming up to the standard required for suprapubic prostatectomy may often be subjected, with safety, to the perineal operation.

In the *perineal operation* there is also a choice, for the dissecting operations are attended with a slightly higher mortality than the simple intra-urethral enucleation of the gland, yet here, also, a better functional result may be expected, because, as performed by those expert, the compressor urethræ muscle is left intact. The median perineal intra-urethral enucleation of the gland is the simplest method of prostatectomy and is attended with the lowest mortality. It has always carried the chances of a relatively poorer functional result; yet there is no operation for removal of the gland that has been performed so badly by most that have employed it. This simple and rapid enucleation method, performed solely by the sense of touch, requires an accurate appreciation of the structures encountered, for while the external sphincter is divided, the vesical sphincter may be left intact, and, moreover, with a certain knowledge, the divided external sphincter may be united following the removal of the gland; a feature generally disre-

garded by most operators who have occasionally employed this method. I have performed this operation over 100 times and have had but a single case of incontinence.

To briefly *summarize the subject of radical removal of the gland,* as I see it, bladder drainage, pre-operative preparation and study will establish how severe a tax may be imposed upon the individual patient within the probable limits of safety. I agree with Squire, Judd, and Young, that bladder drainage secured by the urethra is more satisfactory than by a suprapubic cystotomy. It imposes a less severe procedure at a time when all energy should be conserved. Bladder drainage is quite as satisfactory and if the suprapubic operation is chosen later, it is easier of accomplishment through the primary suprapubic incision than through a fistula established by the two-stage suprapubic operation. If catheter drainage cannot be secured *à demeure* suprapubic drainage is imperative for a period prior to the removal of the gland.

If, as a result of the pre-operative preparation, the patient proves to be an excellent risk, the suprapubic operation is chosen, because of the more rapid and satisfactory functional result. If, on the other hand, the patient's condition is proved to be below the standard required for the high operation, the perineal route is chosen. The best of this group may be subjected to the dissecting operation and the poorest to the median perineal enucleation method.

If the gland is proven to be of the small fibrous type, the perineal dissecting operation is the procedure of choice, even if the patient's condition is of the best, for the amount of prostatic tissue is small and intimately bound to the capsule surrounding the gland and most difficult to remove. I have often employed the technic of Proust; making a hemisection of the prostate along the floor of the prostatic urethra, but not ligating the ejaculatory ducts. The prostatic tissue is then dissected away, by enucleation, if possible; but more often cutting instruments are necessary. More recently I have not opened the urethra at any point, but have carried on the dissection through the prostatic capsule, clamping the prostatic tissue close to the urethra, as suggested by Rydygier, and then cutting it away. The results by this method have been more satisfactory as no perineal drainage of the bladder is required.

Glands proven to be carcinomatous are not dealt with in a radical manner, as the procedure is a severe one attended by a high mortality and is followed by a poor functional result. If, however, benign hypertrophy exists together with carcinoma, and the patient's condition is such as to permit of the removal of the benign portion, this should be

done. Without associated benign obstruction, patients with carcinomatous glands should properly fall into the non-operative group.

*Post-operative Care.*—The pre-operative preparation, and observance of details in every way to minimize the tax imposed on the individual, prior, during, and after the operation, has an important bearing on post-operative complications and the final result. The value of personal attention on the part of the experienced surgeon and specially trained nurse cannot be over-estimated; for attention to details and the early recognition and treatment of complications are essential to success in prostatic surgery. It is for this reason, chiefly, that prostatic operations differ from most surgical procedures, and, if the best results are to be attained, the patient had better be sent to the surgeon than to have the surgeon go to the patient, who has been mentally but not physically prepared for operation by his physician, who may expect the operation to be performed immediately and to attend to the after-care himself.

The *complications* may be divided into two classes—local and general. The local disturbances are hemorrhage, wound infection, phlebitis, epididymitis, pyelonephritis and cystitis. The general complications are shock, cardiac embarrassment, apoplexy, embolus, intestinal stasis, hypostatic congestion, with or without pneumonia, and acute renal suppression.

*Local Complications.—Hemorrhage:* Hæmostasis at the time of operations is important. The amount of bleeding will vary with the particular operation employed and will depend much upon the skill of the operator in his ability to appreciate that he carries out the enucleation entirely within the capsule of the gland. The line of cleavage between the gland and its capsule varies within wide limits; and while some glands may be enucleated with ease without disturbing surrounding or overlying tissues, others are removed with more difficulty and result in opening vascular areas in the capsule, and tearing of the mucosa at the vesical neck, which may result in enough bleeding to play an important part in the recovery, if left unrecognized. It is important to gain a decisive knowledge as to whether or not the bleeding after removing the gland is sufficient to require attention, and there is probably no technical point upon which operators are more at variance. Some insist that it is rare that hemorrhage from the prostate area requires any attention, and argue that a moderate amount of bleeding will take care of itself, and that, as most prostatics have a high blood-pressure, slight bleeding is beneficial rather than otherwise. There are others, however, who insist that prostatic patients are such

poor surgical risks that this bleeding is an important factor in lessening the patient's general resistances and that complete hæmostasis is most essential. As previously stated, my feeling is that cases vary considerably in regard to the amount of bleeding present, which is dependent chiefly upon the type of gland and the skill with which it is separated from the surrounding tissue. If there is any question of whether or not the bleeding is more than is safe to leave, there are several procedures that may be carried out to control it.

If the operation has been by the suprapubic route the Hagner bag is the simplest and quickest method of controlling the bleeding; for by its use the cavity from which the gland has been removed is filled by an even, firm pressure, and as the bag projects upward through the vesical sphincter bleeding from torn mucous membrane about the vesical outlet is also subjected to the same pressure. Applying a sponge soaked in boiling water, massaging the cavity with the finger, while it contracts, as done by Freyer, or sewing up the torn edges at the vesical sphincter are methods at our command. All are time-consuming and are only necessary in the exceptional case. As a rule, slight bleeding cares for itself by clotting, provided the bladder is not irrigated for twenty-four hours. Hæmostasis of the bladder wall and abdominal incision, however, should receive careful attention, for bleeding from these tissues is of real importance. When the bladder is much distended prior to the cystotomy, the vessels on its surfaces become more engorged than if the bladder distention is little. It is often difficult to avoid these vessels while opening the bladder, and care should be taken to see that any that are cut are included in the bladder suture. The same care should be given to vessels in the abdominal incision.

If the gland is removed by the perineal route, either by the dissection or median enucleation methods, a packing of gauze soaked in 1 : 10,000 adrenalin solution is placed in the cavity of the capsule on either side of the drainage tube, for the reason that by the dissecting operation the fibrous capsule of the gland, containing the venous plexus, has been opened.

When the "punch" or Bottini operation has been performed, a de Pezzer catheter drawn firmly into the vesical sphincter, thus making pressure on the incised areas, usually controls the immediate bleeding; yet following the "punch" operation I have been obliged, on a few occasions, to do an external urothrotomy to control the hemorrhage by a larger tube than could be passed through the penis.

*Delayed hemorrhage* occurs rarely but occasionally takes place most unexpectedly. It is usually due to the opening of a vessel by

slough, which separates days and even weeks after operation. It may be controlled best, from above, by the Hagner bag, and from below by packing and a firm perineal dressing and the application of an ice-bag. Small irrigation of the bladder with astringents, rest, morphia and horse serum are of value. When it occurs in connection with a "punch" or "galvanocautery" operation, an ounce of adrenalin 1 : 5000 injected into the bladder usually suffices to control it.

So far I have never seen a fatal case of hemorrhage following any prostatic operation. The minimizing of bleeding is, however, important in conserving the patient's strength.

*Wound infection:* This applies almost entirely to the suprapubic operation, as the perineal approach is peculiarly free from this complication. A clean bladder medium to minimize the chance of infecting the wound, care not to traumatize the abdominal incision, and not to open the pelvis to any great extent by freeing the lateral walls of the bladder are features which play an important part in dealing with this complication. Complete hæmostasis of the bladder and abdominal incision, whereby infection is not invited from this source, is also to be considered. The fascia and skin should be carefully approximated by loose interrupted, non-soluble sutures, and the drainage tube should be left five days to wall off the adjacent tissues from the urine which will escape following its removal. Infection once taking place may result in sloughing of the rectus fascia and muscles, and, if reaching the pelvis, results in a pelvic cellulitis from which phlebitis and pyelonephritis are prone to occur. There is no more distressing complication, and unless the patient has much reserve strength an unfavorable outcome will result. The slightest evidence of infection calls for immediate and free opening and drainage of the field.

*Epididymitis:* This complication seems to occur frequently with some operations and rarely with others, and is dependent, in my opinion, to not keeping the scrotum well elevated throughout the entire convalescence. It is argued by some that it is prone to occur with urethral drainage, yet, while I have generally employed drainage in this way, it has occurred but rarely. As a rule, epididymitis following prostatectomy is unilateral, mild in degree, and rarely suppurates. It is, of course, a secondary infection, and freedom from it will depend upon keeping the urinary tract clean and the scrotum constantly elevated.

*Pyelonephritis:* This condition when pronounced following operation most frequently exists in some degree prior to operation. Infection in the kidney, even to the degree of pyelonephrosis, is not an uncommon associated feature to prostatic obstruction, and every attention should

be given to it in the pre-operative preparation, that whatever attention it may require following operation will be more responsive. Even when the pre-operative study has proven infection to be absent or of slight degree, an acute manifestation of the condition may take place even when there is no infection in the field of operation and the bladder is relatively clean. It may occur at any time during the convalescence, although its onset is usually a few days following operation. A failing appetite, dry, thickened, cracked tongue, a rising continuance septic temperature, a fall in the twenty-four-hour amount of urine, with or without chills and sweats or pains in the back, call for immediate attention in the way of forcing fluids, liquid nourishment, bowel cleansing, urinary antiseptics, and proctoclysis in the form of a 10 per cent. glucose solution; caffeine and whatever stimulation (probably digitalis) may be required. Pyelonephritis is the concealed enemy to prostatic patients; nothing should be watched for more carefully, and the first sign of its presence demands the promptest and strictest attention.

*Cystitis:* This condition usually exists prior to operation, and continues in some degree following it. Naturally it varies with the permanent changes present in the musculature and mucosa of the bladder. It is generally admitted that patients without this complication prior to operation are poorer risks than those with a chronic bladder infection, to which they have been attenuated. It may be considered impossible to prevent cystitis in prostatic patients following the institution of bladder instrumentation, and those with a clear urine may be expected to develop a low-grade cystitis during the pre-operative drainage of the bladder. This is favorable, rather than otherwise, if the patient is not subjected to operation prior to the establishment of an immunization against it; for the bladder infection which otherwise must be expected, following operation, will occur at a time when the patient is in a less resistive state.

The treatment of the cystitis following operation consists in sufficient drainage and irrigations with potassium permanganate, silver preparations, boric acid solutions, and by preference alphozone. As the cystitis is usually of an alkaline type, an attempt should be made to render the urine acid by the ingestion of large amounts of fluids and the administration of ten to fifteen grains each of hexamethylenamin and acid sodium phosphate, in solution, every four hours. When this is not sufficient to accomplish the object, and alkaline salts become deposited on the drainage tube or the edges of the wound, the instillation of a concentrated solution of the lactic acid bacillus or the bacillus aciduric will kill off the alkaline group of organisms, render the bladder acid,

and promptly prevent the deposition of alkaline incrustations. The urine should be kept acid at all times following operation, as the comfort of the patient will depend, in large measure, upon the absence of cystitis. As a rule, an active cystitis following operation is dependent upon the inability to empty the bladder entirely, or to the presence of concretions. When the operation has been undertaken without a cystoscopic or cysto-or cysto-ureteropyelogram a persistent cystitis is most likely to be due to a diverticulum, harboring an infected urine, with or without calculi. An example of this condition occurred in an elderly gentleman upon whom I did an emergency prostatectomy after twenty days' preliminary bladder drainage; with the result that following operation he had a foul residual urine of 18 ounces. Cystoscopy and a cystogram, when his general condition permitted, showed that a diverticulum, larger than the bladder itself, was present.

Cystitis following operation should receive attention. If a residual urine exists, further examination of the bladder is necessary to find the cause, and without a residual urine the bladder should be made as clean as possible by internal medication and local cleansing, with every attempt made to keep the urine acid.

*General Complications.—Shock:* Whatever operation is performed upon the aged is a factor which will tax the vitality, at least temporarily, and the more severe the operation the more the resistance is impaired. This is a matter for important consideration in most prostatic operations. The condition of the patient immediately following the operation will depend much upon the attention to details incident to the operation. The conservation of body heat, having everything ready before the patient receives the anæsthesia, giving the smallest amount of anæsthetic necessary to perform the operation, skill in its performance, and no delay or exposure in returning the patient to a well-heated bed will have an influence on the immediate reaction to the operation. Too much attention cannot be given to the establishment of confidence in the patient's mind as to the outcome of the operation. Many prostatic patients have the preconceived idea that death will be the result, not only because of a long period of suffering, loss of sleep, etc., whereby they see little worth living for, but because most men in the prostatic age have lost friends suffering from the same trouble, and in the period of distress their minds look forward to death as a preferable consequence. Without the establishment of a confidence for a favorable outcome the patient may make no effort in his own behalf; and, while perhaps this condition does not properly belong under the subject of shock, the mind plays no small part in influencing the con-

dition of shock incident to the operation. Not only is the establishment of a nerve block by local infiltration of value, as outlined by Crile, but when an operation is performed by local anæsthesia alone, the influence of the mind should be eliminated by some hypnotic, preferably scopolamine with a little morphia. This eliminates the fear incident to the immediate pre-operative hour and entrance to the operation room, prevents the activity of the mind during the operation, and leaves the patient with diminished sensibilities immediately following the ordeal. The shock incident to hemorrhage is a feature in itself and properly belongs under the subject of hemorrhage.

*Cardiac embarrassment:* While this condition is often present prior to operation, pre-operative attention by rest and other therapeutic measures, especially by the use of digitalis, leaves little to fear from this cause *per se,* unless there is pronounced evidence of a broken compensation which pre-operative treatment will not improve. Under these latter circumstances some relief other than a radical operation is indicated.

*Apoplexy:* This condition is not an infrequent accompaniment in prostatic patients, prior, as well as following, operation. I have several times operated upon patients who have passed through apoplectic attacks, without their recurrence following operation. On two occasions I have seen such attacks develop during the pre-operative preparation, without anything being done other than to establish bladder drainage by a catheter passed through the urethra. I have had three patients develop the condition following operation while still in the hospital. There is little that can be done other than to employ the usual, less severe, measures to lessen high blood-pressure.

*Embolus:* The entrance of a piece of blood-clot into the general circulation is a complication that occasionally occurs, and may result fatally. It is readily appreciated that clotted blood in the plexus of *Santorini* is to be expected, following the removal of the prostate. It is of importance, for this reason, to avoid large rectal injections in the form of enemata, and to avoid likewise constipated bowel movements following the operation. All immediate urethral instrumentation should be avoided, if possible, and, if necessary, undertaken with the greatest gentleness and with small and soft rather than hard, instruments, in order not to injure or dilate the prostatic area of the vesical sphincter.

*Intestinal stasis:* This condition is prone to occur, both because of the sluggishness of the musculature of the alimentary tract incident to old age, and because of the toxæmia which frequently accompanies

impairment of the kidneys' power of elimination, and the presence of sepsis. As a rule, the patient's bowels should be moved on the third day following operation by the administration of Pluto water or Epsom salts, and at no time thereafter should the bowels be allowed to become constipated. If there is a tendency for this to occur, an anti-constipation diet and a daily cathartic should be employed. In no event, other than emergency, should enemata be administered. In marked stasis, hot poultices to the abdomen and pituitrin are of value, together with attention to any cause, such as sepsis, to which the stasis may be attributed.

*Hypostatic congestion and pneumonia:* Elderly persons confined to the dorsal position are most susceptible to pulmonary congestion and, following a general anæsthesia, especially ether, to a pneumonia. For this reason gas oxygen and spinal anæsthesia are, as a rule, the anæsthetics of choice. Patients naturally vary in regard to how much they may be advanced following operation; but every attempt, within reason, should be exerted to get them into the sitting position in bed, and to get them out of bed at the earliest moment consistent with their strength. A vigilance for lung complications is important, and if they take place they should be promptly recognized and appropriate treatment immediately instituted, even at the expense of interference with local conditions.

*Acute renal suppression:* While everything may have been done in the pre-operative preparation to establish a stable maximum efficiency of the kidneys, uræmia may, nevertheless, develop. It is observed in two types, either a diminished output of urine, probably due to the acute congestion of the kidneys, or a large output of urine of low specific gravity, probably due to interstitial kidney changes which result in an impaired power of eliminating effete products from the blood. The patient begins to lose interest, the appetite fails, he becomes drowsy, the tongue becomes thickened, dried and furrowed, hiccoughs may develop, the temperature falls below normal and he may gradually pass into a muttering delirium or coma in from twenty-four to forty-eight hours. The onset of these outward symptoms should be appreciated and treatment immediately begun to stimulate the activity of the kidneys, by giving digitalis intramuscularly, or caffeine sodium benzoate, grains two, every three hours by mouth; or by repeated injections of about a quart of salt solution or 10 per cent. glucose solution intravenously, subcutaneously, or as a constant rectal drip. If the kidneys fail to show proper response, stimulation of the skin by hot packs and the bowel by saline laxative must be employed as the means

of eliminating the toxic products which the kidneys are unable to care for. Success in dealing with this complication will depend only upon early recognition and intelligent treatment and nursing. When the patient is allowed to pass on to the stage of hiccough, delirium, and coma, recovery rarely takes place.

*Habits:* A knowledge of whatever eccentricities or habits the patient may have has a considerable bearing on the post-operative period. Aged persons who have come to rely on certain mental features and those who have been addicted to the use of tobacco, alcohol, tea or coffee had best be given all latitude, within reason, in the pursuit of such addictions. Everything should be done to allow the patient to live as near his usual methods as possible; for old established habits have much bearing, both mentally and physically, on the well-being of the patient.

## CONCLUSIONS

1. Prostatic patients form the most aged group of individuals commonly requiring surgical relief.

2. Pre-operative study and preparation renders the patient more suitable for the operation; or determines him to be inoperable.

3. No one operation is suitable for all cases, because of variation in the type of the gland, and because of the more important variation in the vitality of this class of patients. The appropriate operation for the individual patient should be chosen.

4. Details to conserve the patient's strength at all times are important.

5. Unusual vigilance in the post-operative period, the early recognition of complications, and immediate institution of appropriate treatment play a very important part in the convalescence and mortality.

# CONGENITAL STRICTURES AND SPIRAL TWISTS OF THE URETERS*

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of Chicago, Ill.

In my first and second papers [1] upon this subject, I reported four cases of congenital strictures of the ureter, and in a third communication [2] a fifth case was added. Of the first four cases, the stricture had not given rise to any clinical symptoms in one case, the specimen being obtained at the autopsy of a ten-days-old infant, who had died of icterus neonatorum. A second case of the first four occurred in one-half of a horseshoe kidney, and it was not clearly established at the time of operation whether the hydronephrosis was the result of a stricture at the ureteropelvic junction or of a faulty insertion of the ureter. In view of these facts, I have eliminated the two cases from my list and shall only consider as true congenital strictures the remaining three of my former cases which caused clinical symptoms, and can now add a fourth recent case to those previously reported.

A brief résumé of the most important facts in regard to my first three cases may be of interest before the details of the fourh case are given.

Case I.—Boy of twelve. Referred on account of gradually increasing size of abdomen for past six years. Latter greatly enlarged, especially in left half, by soft elastic tumor lying behind inflated colon. No clinical symptoms except those of increased intra-abdominal pressure. At operation left kidney was found converted into an enormous hydronephrotic sac. Cause of obstruction was stricture of the ureter close to renal pelvis, which did not even admit a filiform bougie (*A* in Fig. 1). Uneventful recovery after nephrectomy.

Case II.—Boy of fourteen, previously well, had sudden attack of left-sided abdominal pain with fever, localized rigidity and tenderness. Under deep anæsthesia, spindle-shaped swelling felt behind left rectus muscle. Upon opening abdomen, ureter found size of small intestine, very thin-walled and containing turbid urine. Local evidences of peri-ureteral infection. Ureter showed two points of narrowing, one close to renal pelvis of moderate degree

* Read at the March 15, 1917, Meeting of the Chicago Urological Society.

(*B* in Fig. 1) and a second one just above bladder. At the latter point the ureter suddenly changed (*B* in Fig. 1) in size and became a fibrous cord for a distance of one inch. Through this stricture a very fine probe could still be passed. The kidney showed a moderate degree of hydronephrosis, but in the cortex

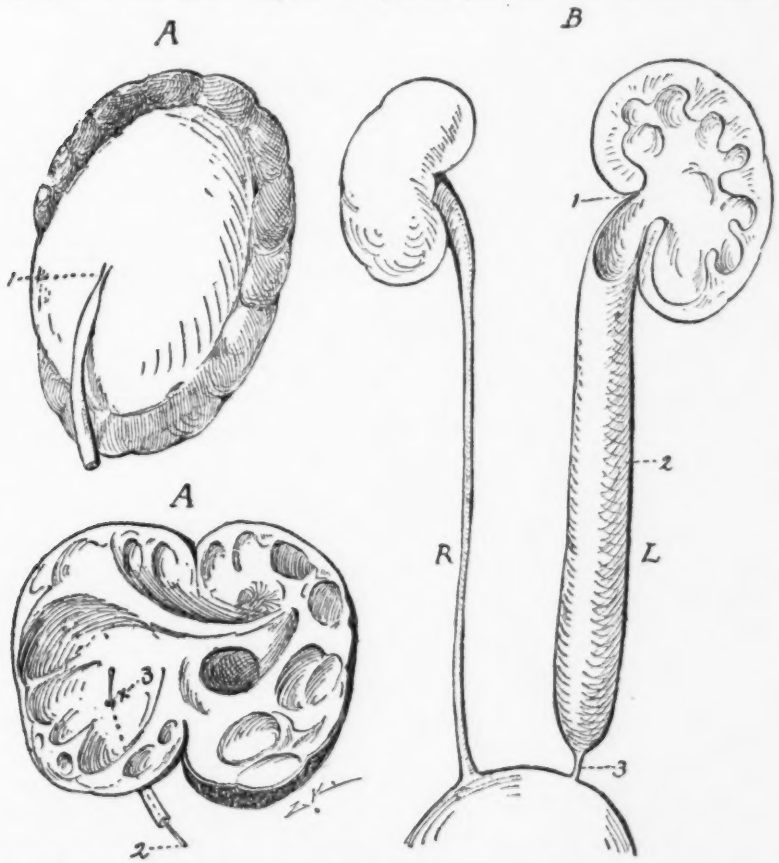


FIG. 1.—*A*, exterior and interior of kidney from Case I, showing location of stricture at ureteropelvic junction (1). The narrow opening of the ureter into the renal pelvis is shown at X near 3 in lower illustration of *A*. 2 represents probe inserted through the stricture into dilated renal pelvis. *B*, diagrammatic view of Case II, showing slight narrowing of the greatly dilated left ureter (2), at ureteropelvic junction (1), and almost complete obliteration just above bladder (3).

there were a number of small abscesses. Recovery after nephrectomy and ureterectomy.

CASE III.—Girl of sixteen with stigmata of cretinism was admitted to the hospital on account of severe pains in abdomen accompanied by vomiting. These symptoms had appeared suddenly about two weeks before admission. At the first examination an enlargement in the suprapubic region was felt and an ovarian

cyst with twisted pedicle suspected, but the tumor disappeared to a great extent shortly after a catheter was introduced and a large amount of turbid urine obtained. A suprapubic swelling still remained however. A cystoscopic examination was considered in-

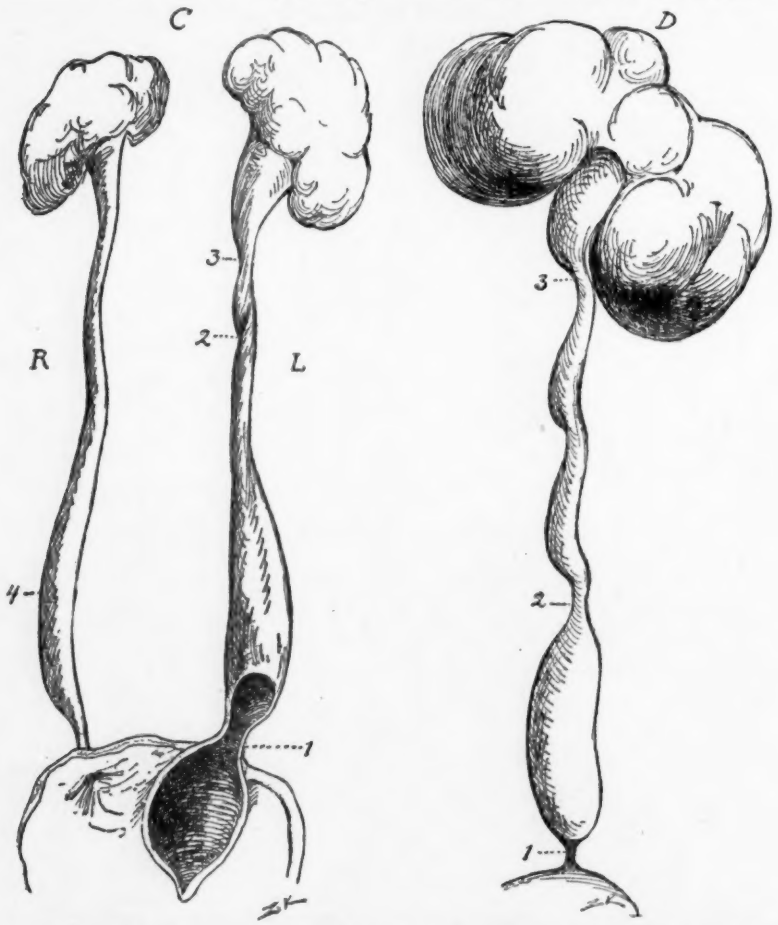


FIG. 2.—*C*, diagrammatic view of Case III. The cystic dilatation of the vesical end of the left ureter with a narrowing as it passed through the wall of the bladder is shown at 1. The spiral twist of the same ureter is shown at 2, and the narrow portion of the ureter at the ureteropelvic junction is at 3. The greatly dilated right ureter (4) was moderately stenosed above bladder, the chief cause of obstruction on right side being pressure of the intravesical cystic dilatation of the left ureter upon the right ureteral orifice. *D*, Case IV (see also Fig. 3) with impermeable stricture at 1 and narrowings at 2 and 3.

advisable, so abdomen was opened in median line. Both ureters and kidneys were found much enlarged (*C* in Fig. 2). The left ureter ended in a blind sac within the bladder and was dilated as far up as its junction with the renal pelvis, where a marked spiral twist of the ureter acted as a second cause of obstruction (Fig. 3).

FIG. 3.—Ureter of Case III, showing spiral twist at junction of upper and middle thirds, with resultant obstruction of renal pelvis.

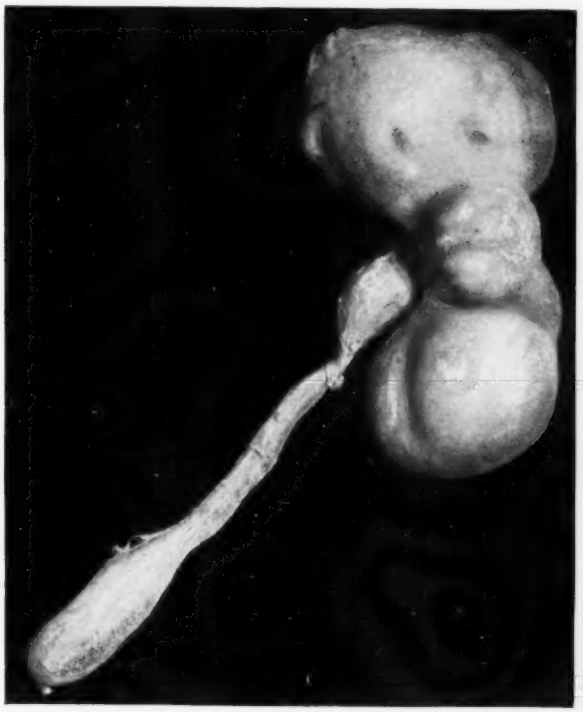

FIG. 4.—Photograph of kidney and ureter of Case IV. Note advanced degree of hydronephrosis with constriction of ureter of moderate degree close to renal pelvis and complete obliteration of lumen above the bladder. The ureter just above this impermeable stricture was the size of the small intestine.

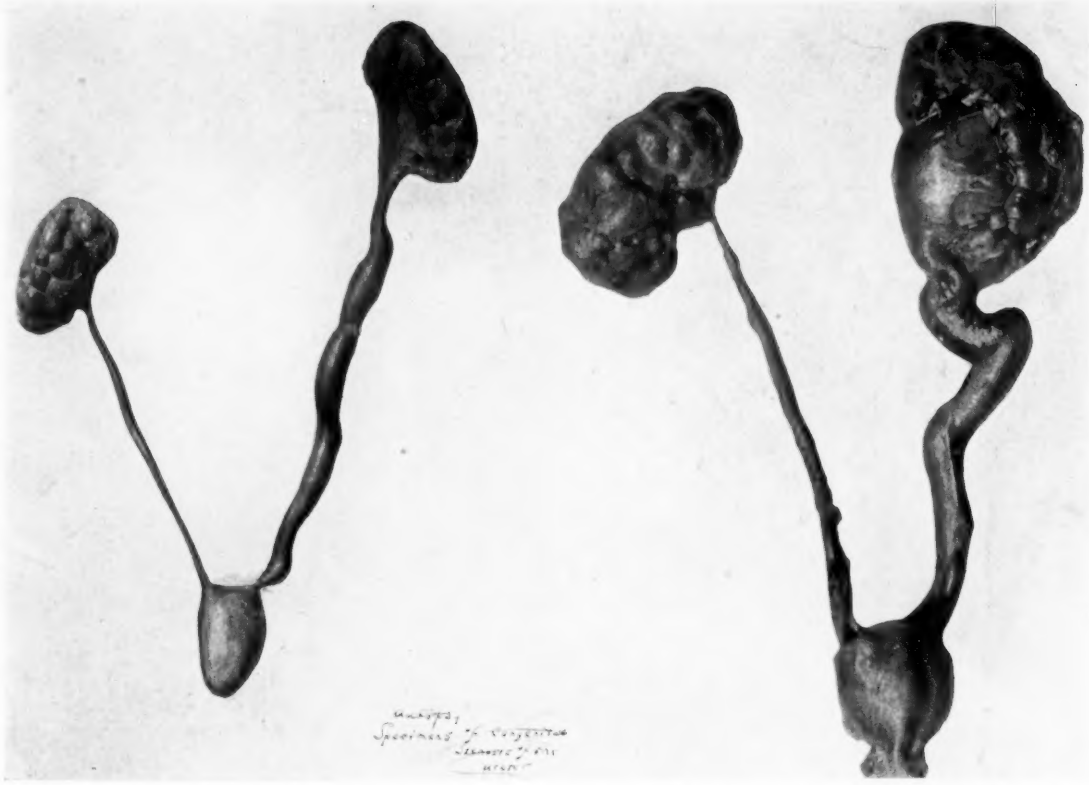

FIG. 5.—Two specimens showing congenital strictures of the ureter obtained at autopsies of infants by Dr. H. O. Mertz of La Porte, Ind. Specimen on left shows stricture near bladder and just below renal pelvis in left ureter. Specimen on right shows marked dilatation of entire left ureter and renal pelvis with closed lower end of ureter, as in author's Case III.

A plastic operation was first performed on the closed vesical end of the ureter, and later a ureteronephrectomy on this side. Patient died of uræmia five months after the second operation. The right ureter showed, at autopsy, a narrowing just above the bladder with marked dilatation of the remainder of the ureter and of the renal pelvis.

A fourth case has been recently observed which I desire to add to the three preceding ones.

CASE IV.—Male, aged twenty-six, referred by Dr. I. B. Diamond of Chicago, with diagnosis of left-sided renal infection. History of recurrent attacks of left-sided abdominal pain since age of fourteen. At first, the attacks would recur at intervals of six to eight months, the pain being of a dull aching character, radiating from a point a little to the left of the umbilicus towards the left kidney region and lasting about six to seven hours. During these attacks he noticed considerable left-sided abdominal enlargement with vomiting and marked constipation. He had never observed any disturbances of urination. He had only two attacks during the five years preceding the one for which he was sent to hospital. One of these two attacks had continued for nearly two months.

Upon admission to my service at the Michael Reese Hospital on February 14, 1917, he stated that the present attack of left-sided abdominal pain had begun suddenly about two weeks before. Examination revealed a soft elastic enlargement on the left side of the abdomen, extending from the level of the anterior superior spine of the ilium below to the costal arch above and disappearing under the latter. The ability to palpate the rounded lower and inner borders of the soft elastic enlargement and its location behind the inflated colon led me to conclude that a very large hydronephrotic sac was present, due to some form of ureteral obstruction. There was a moderate degree of leucocytosis and rise of temperature. Radiography of the urinary tract was negative. Cystoscopic examination showed the bladder to be normal except for a slightly prominent left ureteral orifice. Catheterization of the right ureter was easily carried out and showed a normal, functionating kidney with an excretion of 24 per cent. phthalein in the first hour. On the left side there was complete obstruction of the lumen of the ureter at a point just above the bladder. Even a filiform ureteral catheter could not be passed through the strictured portion; so all attempts to make a ureterogram were abandoned. The diagnosis was made of a congenital stricture of the ureter in its pelvic portion with secondary hydronephrosis.

At operation (February 18, 1917) we exposed the kidney through the usual incision. The kidney was represented by a

hydronephrotic sac which extended from the brim of the true pelvis to the diaphragm and forward to the median line. The fluid within this enormous kidney was under great tension and had to be evacuated (as in Case II) before the thin-walled sac could be brought into the incision. The ureter was distended to the size of the small gut down to a point about one inch above the bladder, where it terminated abruptly in an impervious fibrous cord (Fig. 4).

The kidney and entire ureter were removed and the wound closed in usual manner. No accessory arteries were found. The kidney after removal represented an extreme degree of hydronephrosis, the cortex being so thin that it would have ruptured spontaneously unless operation had been done. The walls of the greatly dilated ureter were relatively thick. There were two points of slight narrowing above the seat of stricture, one of these being close to the renal pelvis and a second where the ureter crossed the iliac vessels. At the lower end, however, the lumen ended abruptly, and the fibrous cord-like portion which represented the stricture had no lumen. There were no valves in the lumen and no spiral twist in the portion above the stricture as in Case III.

*Review of chief points of interest in author's four cases:*

1. *Location of stricture.* In Case I, there was a slight one close to renal pelvis and a second one, more marked but permeable, just above the bladder. In Case II the stricture was impermeable and located at the ureteropelvic junction. In Case III there was an intravesical pouch formed by the obliterated lower end of the ureter and a second obstruction in the form of a spiral twist just below the kidney. Case IV greatly resembles the second case, the stricture being located in the juxtavesical portion of the ureter, but being impermeable.

2. *Effect on ureter and kidney.* Except in Case II, where the stricture was near the kidney, the ureter was greatly dilated in all. The hydronephrosis was most marked in Cases II and IV, where the strictures were either impermeable or nearly so.

3. *Clinical symptoms and pre-operative diagnosis.* The first symptoms appeared at puberty in all of the cases and were due to infection. Abdominal pain, sudden in onset, dominated the clinical picture of infection except in Case III, where the suprapubic enlargement was a very striking finding. A diagnosis before operation of congenital stricture of the ureter with secondary hydronephrosis was only made in Case IV. In Case II, the diagnosis was hydronephrosis, but the ureteral stricture was not recognized until operation.

4. *Effects on bladder.* No bladder symptoms except in Case III,

where the intravesical cystic dilatation of the left ureter gave rise to retention and also to pressure on the right ureteral orifice and favored ascending renal infection on that side.

*Review of Literature.* The most complete article upon this subject is that of Bottomley [3] in which fifty-six cases reported up to 1910 are collected. Including the fifty-six cases collected by Bottomley, four of my own and seven published since 1910, a total of 67 cases are now on record. One of the most interesting of the cases which have caused clinical symptoms is that of Lower.[4] His patient was a boy of eighteen with frequent attacks since infancy of left-sided abdominal pain. The last attack was accompanied by severe pain, chills and fever. Radiography showed the shadow of a calculus in pelvic portion of left ureter. It was extremely difficult to find the calculus at operation because it migrated easily within the lumen of a widely dilated ureter. This dilatation had taken place between two congenital constrictions of the ureter, one close to the bladder and a second one near the renal pelvis.

*Etiology.*—This is not quite clear, but is best explained as either the result of the persistence of fetal conditions or a retardation of development of structures destined to perform important functions.

*Persistence of Fetal Conditions.*—Seitz,[5] Byron Robinson,[6] Hamann,[7] Caspar,[8] and others have shown by their studies of the normal ureter, in the fœtus and at different periods of post-uterine life, that the ureter in all mammals possesses certain more or less constant points of narrowing and of dilatation. In addition, the occurrence of valves and of twists or tortuosities is not at all uncommon, especially in the fetal ureter. Fig. 5 shows where these various conditions most frequently occur. The points of narrowing are as follows:

(1) Just before the ureter enters the bladder wall; (2) where the ureter crosses the pelvic brim; (3) close to the pelvis of the kidney.

These three points of narrowing become more marked toward the end of fetal life, as Seitz has shown, and were constantly found in the normal adult ureter by Robinson.

The dilatations are always found on the proximal side of these narrowings in the normal human fœtus. The most marked widening is situated in the middle third of the ureter, *i.e.*, proximal to the narrowing which occurs at the pelvic brim or between it and the bladder wall.

The spiral twists occur at any point, but are most marked at the junction of the upper and middle thirds of the ureter, as in my Case III. The rôle which valves play in the production of stenoses is not quite clear. They are found in about 20 per cent. of cadavers of normal children, and contain mucous membrane, submucous and muscular

tissue. In some cases the ureter is stenosed at the point where valves are found, and in all probability the valves play a rôle here.

*Clinical Importance.*—The presence of the narrowings, twists, and valves, as found in the normal fetal and adult ureter, was formerly thought to be of interest to the anatomist and pathologist alone. Although a number of the cases collected by Bottomley were reports of specimens found at autopsy, yet in quite a large number the persistence of these congenital conditions gave rise to symptoms requiring operative measures.

In several of the cases collected by Bottomley, a portion of the ureter was wholly fibrous, while in others the ureter was impermeable throughout and was represented only by a fibrous cord, a functionless ureter. Teyssedre [9] collected reports of eleven such cases. The fibrous ureter may lead to absence of the kidney or of the whole or a portion of the ureter. In eight cases of Bottomley's series the stricture was located in the upper third of the ureter, usually at or close to the opening into the renal pelvis.

In 36 of 56 cases the obstruction was in or very close to the bladder; 17 of Bottomley's cases had vesical protrusions, 39 did not. Nichols's and Lower's cases showed a stricture both at the upper and at the lower end of the same ureter. A single ureter may present alternating portions with and without a lumen.

The most important, and, in their effects, the most far-reaching modifications of form are seen in the obstructions at the lower end of the ureter. In these the ureter usually reaches the bladder, but in most instances ends there in a blind sac. The protrusions range in size from that of a small pea to one completely filling the bladder lumen. Usually (in 12 out of 17 cases) the protrusions are blind cul-de-sacs without an opening into the vesical cavity. In five cases there was a communication between the protrusion and the vesical cavity, almost invariably by minute openings at the tip or on the side of the former.

*Effect on Ureter.*—When the obstruction is at the lower end, the ureter is almost invariably dilated, thin-walled, and tortuous. It varies in size from that of a pencil to that of the small intestine.

*Effects on the Renal Pelvis and Kidney.*—Either an enormous hydronephrosis or a most marked primary atrophy may result from ureteral obstructions of the same location and character. Hydronephrosis of varying degree is the rule.

*Effects on the Bladder.*—The cystiform protrusions of the blind-ending ureter into the bladder may cause marked secondary pathologic changes in the bladder, as well as in the other ureter, or in the other kidney, as in Case III. The protrusion may block the opening of the

opposite ureter. In other cases it may wholly obstruct the vesical opening of the urethra, give rise to a distended hypertrophied bladder and then the usual sequelæ of retention of urine result. Both the right ureteral orifice and the internal meatus urethræ were blocked by the cystiform protrusion in Case III and the bladder walls greatly hypertrophied.

*Symptoms and Diagnosis.*—A survey of all the published cases of congenital anomalies of the ureter shows that clinically they belong to one of four classes: (1) Those in which the condition remains latent throughout life and is an accidental finding at autopsy. The majority of the published cases belong to this class. (2) Those in which the presence of an abdominal tumor, which may or may not be diagnosed before operation as being of renal origin, is found when the abdomen is opened. (3) Cases in which the predominant symptoms are those of an abdominal infection. The clinical picture may resemble that of an acute infection of one of the intraperitoneal viscera, or it may point more directly to the kidney and ureter as the source of the symptoms of infection. (4) Those cases in which disturbances of micturition are the principal symptom. This consists either of increased frequency or retention.

The examination of the urine is of little value, unless infection has supervened, and even then there is nothing to be found. Ureterography and pyelography and the other methods used in the diagnosis of ureteral strictures and of hydronephrosis are of the greatest value when the stricture is permeable.

*Treatment.*—The treatment depends, first upon the degree of constriction; second, upon the damage to the kidneys due to the ureteral obstruction; and, third, upon whether infection is present or not. In the latter class of cases nephrectomy is, as a rule, the only method of treatment. If the kidney has not been too greatly damaged, it may be possible to perform a pyelo-ureteroplasty or implant the ureter into the bladder from a point above the stenosis.

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# OBSERVATIONS ON ANOMALIES OF THE URINARY TRACT

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Anomalies and malformations, mostly of congenital origin, are found in any organ or region of the urinary tract. While the occurrence of these abnormalities of form, position, and number, and particularly those of and above the bladder, is comparatively rare, they assume, nevertheless, great practical interest on account of the appalling diagnostic difficulties they often present to the urologist.

Case I.—*Renal hypoplasia (rudimentary kidney) and hydroureter on the left side.* About ten years ago a man of thirty-five came under observation with the following history: Five years before, shortly after an attack of gonorrhœa, frequent and painful micturition set in. Since that time his urine was always turbid, of strong odor, and containing a heavy sediment of almost pure pus. During that time he had been under almost constant treatment, and at various clinics had undergone several operative procedures without material relief.

The patient looked emaciated and cachectic. His intellect was rather dull. On inspection a longitudinal scar was visible above the pubic symphysis and two horizontal scars with central fistulous openings, emitting turbid fluid, were situated in both iliac fossæ. Irregular septic temperature. Kidneys not palpable. Physical examination negative. Prostate normal per rectum, seminal vesicles not palpable. Urinalysis: Very cloudy urine, slightly acid, low specific gravity, abundant microscopic pus, many blood-cells, no tubercle bacilli; guinea-pig test negative. Radiography negative for renal or ureteral concrements. Cystoscopy: Bladder capacity very small, later on gradually increased to 50 c.c.; bladder wall markedly trabeculated and ulcerated; landmarks of trigone impossible of identification on account of rapid clouding of irrigating fluid.

After many sittings, spent in laborious and systematic search of every groove and slit suggestive of an ureteral orifice, the right ureter was entered by chance, and the catheter pushed forward to the renal pelvis. The right-sided renal secretion revealed fairly satisfactory values for urea and sugar after phloridzin; indigo-carmine appeared after fifteen minutes and showed a good color-index half an hour after injection of the

dye; microscopically a number of pus-cells, small round epithelial cells, some of them degenerated, and fresh blood-cells (due to ureteral catheterization) were recognized.

In spite of most painstaking and often repeated search, the left ureter could not be identified. At times the ureter catheter seemed to slide forward almost its whole length into some groove or hole situated in the region of the left ureteral meatus, but, on account of the almost instantaneous clouding of the field of vision, a decision upon the whereabouts of the tip of the catheter could not be reached. A faintly blue-colored fluid, containing traces of urea and phloridzin-sugar, and in the sediment of which, microscopically, besides pus a few element of renal significance were ascertained, was collected from the catheter. A similar result was obtained from the attempted study of the relative functional and microscopic findings by means of a ureter-catheter *in situ* in the right renal pelvis, and a bladder catheter representing the secretion of the left kidney.

The clinical symptoms and cystoscopic findings, incomplete as they were, obviously pointed to the existence of a left-sided pyonephrosis, resulting in complete destruction of the kidney on that side. On account of the rapid deterioration of the patient's condition, removal of that organ was decided upon.

In chloroform narcosis the usual incision for exposure of the kidney was made in the left loin, which was carried down to the transverse fascia; but in spite of careful search no organ of the size, shape or consistency of kidney was found. In scanning the operative field in various directions, the peritoneum was opened, and various parts of intestine and the spleen were palpated and recognized.

After closing the peritoneum, the incision was extended downward and forward for exposure of the ureter. An oblong-shaped body, located outside the peritoneal sac, of soft consistency and surrounded by a great deal of connective tissue, was thought to be, in all probability, the ureter, though, on account of its width, it could not with safety be differentiated from intestine (ascending colon). With this doubt in mind, a small incision was made in its wall, through which a catheter was pushed down the tube; colored fluid, injected through this catheter, was recovered from another catheter lying in the urethra, proving by these means the identity of the tube with the left ureter.

The operation by this time had lasted unusually long, and the precarious condition of the patient made its rapid termination imperative. The upper end of the ureter was, therefore, freed from surrounding adhesions with the utmost despatch; it was then ligated and removed; closure of wound in usual manner.

The specimen containing the upper end of the ureterorenal sac showed a slight widening at its upper half, which measures about 2.5 by 2 cm.; when opened, the mucous membrane appears to be smooth, separated by a few horizontal folds, and covered with mucopurulent shreds; no renal pelvis or renal tissue could be ascertained on macroscopic inspection. Dr. Ophüls' report upon the histological examination was as follows: "Nothing of kidney tissue found. The specimen shows connective tissue of involuntary muscle fibres." Nothing suggestive of a renal pedicle could be traced. No vestige of an adrenal gland was found.

The specimen was, unfortunately, lost at the pathological laboratory and, therefore, cannot be reproduced in this connection.

The patient made a slow, but uneventful, recovery. His general condition and urinary symptoms improved materially, though the urine remained cloudy and always showed microscopic pus. Cystoscopy, several months after the operation, revealed marked increase in capacity (150 c.c.), the landmarks of the trigone could now be recognized, the right ureteral orifice was normal in size and spurt, while at the site of the left meatus a diverticular opening of about 2.5 cm. diameter was noticeable, into which a ureter-catheter could be pushed forward a distance of about 25 cm., corresponding to the point at which ligation of the dilated ureter had been done.

The fistulæ in the iliac fossæ had closed soon after the operation, while that in the loin remained open for several months. An attempt to close that fistula by paraffin injections resulted in the formation of a concrement in the bladder, which, later on, was recognized cystoscopically and removed by means of the lithotrite.

About a year after the operation the patient returned from a long sojourn in the mountains, much improved in health and strength, and with the fistula in the left loin entirely closed. His bladder capacity had increased to about 250 c.c., frequency in micturition was slightly increased, urine somewhat cloudy, containing a small amount of microscopic pus; his bladder contained about 50 to 100 c.c. residual urine; cystoscopy revealed an almost smooth bladder mucosa and a moderate cystitis, while the findings at the trigone were identical with those noted above.

The patient was now able to resume his usual occupation.

During the next two or three years the patient's urinary symptoms gradually increased in intensity, while his ability of spontaneous evacuation of urine had markedly diminished, the bladder always containing between 200 and 300 c.c. of cloudy, purulent and malodorous urine. In spite of careful local treatment, including direct irrigation of the dilated left ureter by means of a large

FIG. 1.—Hydro-ureter.

FIG. 2.—The excised ureter.

FIG. 3.—Showing stump of ureter.

calibered ureter-catheter, uroseptic symptoms, increasing in gravity, set in. A pyelogram made at that time revealed the irregularly shaped bladder shadow, from the left side of which the shadow of the hugely dilated ureter was seen to rise above the bony pelvis (Fig. 1).

In spite of the patient's unsatisfactory condition and his reluctance to additional surgical procedures, the removal of the left-sided hydro-ureter was decided upon.

In gas-ether narcosis by an incision, carrying the original loin incision downward and forward, the ureter was extraperitoneally dissected to a point about 2 or 3 cm. above the bladder, where the tube, unfortunately, tore off. The wound was closed, leaving a small fistula for a gauze drain, carried to the stump of the ureter. The length of the excised ureter was 21 cm., its width was of variable calibre, measuring at its maximum 2.5 cm. (Fig. 2).

The patient made a slow recovery. A pyelogram taken about six weeks after the operation shows the stump of the left ureter (Fig. 3).

At his discharge from the hospital, the patient was able to evacuate his bladder completely; urine almost clear; general condition rapidly improving. He resumed his occupation in the country, from where he sent several satisfactory reports upon his condition.

In the fall of 1916, about six months after the last operation, the information reached me from a hospital in a Northern Californian town, that the patient had died there, two days after operation, for strangulated hernia, incidental to fall from a horse.

Hypoplasia or rudimentary development of the kidney, according to Ballowitz,[1] represents the comparatively most frequent renal anomaly. The first authentic case of that type recorded in the literature dates back to the year 1677,[2] while the next case was reported almost 200 years later by Sidney Jones.[3] Since then quite a number of similar cases have been published. An analysis of the reported cases does not reveal particularly interesting data as regards age or sex. Only in a few instances an abnormal location of the hypoplastic kidney is noted, as in Rosenberger's [4] case, where the rudimentary organ was situated within the bony pelvis to the right of the rectum. As regards its size the hypoplastic kidney is, in most instances, compared to a walnut, flattened date, or a bean. Measurements, where they have been recorded, give the length and width of the largest specimen as 4.5 by 1.5 cm., while measurements of the smallest specimen were 1.5 cm. by 7 or 8 mm. As regards weight, I can only find one reference,[5] in this the specimen weighed less than 1 gramme.

According to their structure, the examined specimens were mostly composed of dense connective tissue. In the few cases in which a microscopic examination was made, only small islands of well-formed renal tissue could be differentiated from the surrounding mass of fibrous tissue. In one case reported by Tissèdre,[6] a few isolated glandular acini, but no glomeruli, were found. Neither could Eppinger,[7] on painstaking microscopic study of his case, detect in his slides true glomeruli, though he found a few collecting tubules.

In the majority of cases of renal hypoplasia, like in my own case, no renal pelvis existed. The ureter was either missing, or it was an entirely impermeable fibrous cord, or it possessed a very narrow and partially obliterated lumen affording no communication with the bladder.[8] Boström[9] directed attention to various anomalous conditions at the lower end of the ureter, which are particularly frequent in cases of renal hypoplasia connected with duplication of the ureter. According to Küster[10] the ureter in renal aplasia, or congenital renal atrophy, frequently ends blindly either above or below; its width varies between that of a hair or of a large sac. Unusual shortness of the ureteral channel is generally connected with an abnormally low position of the kidney, while cases of atrophic kidney, complicated by ureteral duplication, present an abnormal length of either of the two ureters. Abnormal width of the ureteral channel, without the presence of an impediment to free urinary flow, is, according to Meckel,[11] always indicative of persistence of fetal development of the ureter, which, also, under normal conditions, in the mature fœtus is comparatively much wider than in the adult.

Of practical interest, as regards the frequency of the condition, is Morris'[12] statement that aplastic and hypoplastic kidney occur in about 0.02 per cent. of normal kidneys.

Küster[13] differentiates two groups of rudimentary kidney according to their development. In the first group either the whole or a part of the anlage of the kidney has suffered developmental arrest at a very early stage, while the second group comprises those cases in which the kidney possesses normal form and structure, but is abnormally small (atrophic kidney).

My own case evidently belongs to the first group. Developmental arrest of the left kidney and ureter, in all probability, must have occurred at a very early stage of fetal or post-fetal life. Owing to huge dilatation of the left ureter, infection of the tube and its hypoplastic renal appendix was established at the first provocation (cystitis colli after gonorrhœal infection) and of necessity became irreparable; by

these means destruction of any real parenchymatous tissue present in the kidney occurred, and a condition identical with complete renal aplasia ensued.

These deductions, though, are merely of academic interest; from the standpoint of practical surgery the differential diagnosis between renal hypo and aplasia is of no import, since the former condition always produces an anatomically and functionally valueless organ.

Pyelography, which was not available at the beginning of my observation, would in all probability have given important additional diagnostic data, so that ureterectomy could have become feasible in one sitting. I doubt, though, whether an exact pre-operative diagnosis would have been possible on the basis of pyelographic evidence.

CASE II.—*Horseshoe kidney (fused type); bilateral nephrolithiasis; pyonephrosis of right side.* About five years ago a man of thirty-two entered the hospital on account of severe pyuria and intermittent attacks of right-sided kidney colic. No important data as regards previous affections of the genito-urinary tract could be elicited from the history. The patient, who is an enthusiastic mountain climber, noticed the first untoward urinary symptoms shortly after an unusually hazardous mountain trip, which occurred only a few weeks prior to his admission to the hospital.

Physical examination negative. Kidneys not palpable. Irregular septic temperature, between 100 and 102° F. Daily urine quantity about 500 c.c. Urine cloudy, containing mass of microscopic pus; daily urea quantity about 15 grammes or less. Patient slightly comatose.

Cystoscopy demonstrated a moderate cystitis; both ureter catheters could be pushed forward as far as the renal pelvis, but no fluid was coming forth from the right, and very little urine was collected from the left renal catheter. Finally, after several cystoscopic sittings, which were unsuccessful as regards obtaining material for comparative functional and microscopic study, a few drops of almost pure pus were withdrawn by suction from the right renal catheter. The comparative examination gave the following result:

| | Right | Left |
|---|---|---|
| Sugar (after phloridzin) | 0.0 per cent. | 0.1 per cent. |
| Urea | 0.001 per cent. | 0.031 per cent. |
| Microscopic: | Almost pure pus; a few small round epithelial cells. | A few pus-cells, many small, round epithelial cells, many blood-cells. |

Palpation of kidneys negative. Radiography showed typical concrement shadows in both kidney regions, almost symmetrically located to both sides of the second lumbar vertebra, a little below

the twelfth rib, and suggestive of a position at or near the renal pelvis. Pyelography, though repeatedly done, did not materially aid the diagnosis, as almost all of the injected silver solution ran back into the bladder; thus only the hazy outlines of slightly dilated renal pelvis were thrown on the plate.

Upon these findings the diagnosis of bilateral nephrolithiasis with secondary infection and destruction of the right kidney (pyonephrotic stone kidney) was made. For obvious reasons and particularly on account of the patient's precarious condition, drainage of the right organ was considered the first and most imperative operative procedure.

*Operation.*—By the usual right-sided lumbar incision the upper pole of the kidney was easily freed; luxation, though, of the lower pole seemed impossible, wherefore the incision was materially enlarged; the kidney was now found to extend downward to the left side of the abdomen toward the bony pelvis. The right half of the kidney, which was, by that time, recognized as of the fused or horseshoe type, was brought up into the incision and found to contain a pus cavity. A calculus of the size of a large olive pit was felt in the renal parenchyma just above the pelvis, and removed by a small incision, which was afterwards closed with catgut sutures. The pyonephrotic sac was incised, emptied and drained by a rubber tube. The kidney was replaced and the wound drained by cigarette drains at its upper and lower ends. Closure of wound by layers.

The following notes were taken three days after the operation: Patient rallied well from the operation. Temperature, 99°; pulse, 100, volume, fair; general condition good. Only a few ounces of purulent urine are thus far obtained by catheter. Bandages wet. All efforts, though, to increase diuresis failed, and the patient died about a week after the operation, under uræmic and septic symptoms.

Important items of the autopsy pertaining to the genito-urinary tract are:

No break in peritoneum over kidney, and the loose tissue around it shows hemorrhagic infiltration.

Bladder filled with thick, creamy pus, ureteral openings normal on both sides; right ureter runs up in normal direction.

Kidney is of horseshoe variety, whose right pyonephrotic half is drained by an incision, in which is a drainage tube.

There are two renal arteries slightly smaller than normal.

The two adrenals are in normal position.

Death was, according to the autopsy report, due to infection of the loose tissue around the right half of the kidney, recent peritonitis and bronchopneumonia.

This case represents the comparatively rare form of horseshoe or fused kidney, presenting a fusion of the upper renal poles, so that the concavity of the whole mass faces downward. The two kidneys, joined by a connecting bridge running transversely across the course of the vertebral column, were *in vivo* displaced medially and inferiorly. Both renal pelves are on the anterior surface of the renal halves and both ureters take their course over the anterior aspect of the connecting bridge in an almost straight line to the bladder, where they insert in an entirely normal fashion. *In vivo* the left renal half was found to be located considerably lower than the right, thus showing both stone shadows at about the same level on the plate.

Fig. 4 is a reproduction of an X-ray photograph of the specimen, showing both concrements *in situ*.

Statistical reports upon the frequency of horseshoe kidney are variable. Among 6200 autopsies, performed in the Pathological Institute of Berlin from 1897 to 1900, this anomaly was found in 6 instances, or in 0.1 per cent.,[14] while Socin[15] observed 5 cases among 1630 autopsies, giving a percentage of 0.3. The condition, therefore, is not so rare as not to be of more practical importance to urologist and surgeon than single or hypoplastic kidney. Quite a number of kidney operations are recorded in the literature in which unexpectedly a horseshoe kidney, with disease and infection of one renal half, was encountered. In some of the reported cases the intended operative procedure was abandoned upon recognition of the true renal condition. Some operators, like Israel,[16] Socin,[17] and Thompson, Mayo, and Harris in this country,[18] were successful in removing the pyonephrotic part of the horseshoe kidney, the remaining part of which was afterwards functionating satisfactorily. There are, though, also found case reports, according to which the unilaterally diseased horseshoe kidney was removed *in toto*, and where the true renal situation was only recognized by the pathologist after the patient's death. The question therefore arises: Which, if any, clinical criteria do we possess, leading towards a probable pre-operative recognition of the existence of an unilaterally diseased horseshoe kidney?

A palpable mass, presenting suggestive configuration and posture; location of radiographically ascertained renal concrement shadows either at or much closer to the spine than in the normal; bilaterally symmetrical dilatation of renal pelves or hydronephrotic conditions, due to the course of both ureters on and over the kidney; and marked cardiac symptoms brought about by pressure upon the descending aorta by the renal connecting bridge: these are the main symptoms, which, in

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A palpable mass, presenting suggestive configuration and posture; location of radiographically ascertained renal concrement shadows either at or much closer to the spine than in the normal; bilaterally symmetrical dilatation of renal pelves or hydronephrotic conditions, due to the course of both ureters on and over the kidney; and marked cardiac symptoms brought about by pressure upon the descending aorta by the renal connecting bridge: these are the main symptoms, which, in

the opinion of various observers, may, under favorable conditions, afford the chance of establishing the pre-operative recognition of fused kidney. A brilliant observer like Israel [19] was by these means able to diagnose hydronephrosis of the right half of a horseshoe kidney before operation, but this is the only pre-operatively recognized case that I can find in the literature. In my own observation none of the symptoms enumerated above were present, and especially the radiographic findings were barren of diagnostic significance, since both stone shadows appeared on the plate at a distance of several centimetres from the spine.

It seems to me, though, as if the pre-operative diagnosis would be feasible in some instances by considering in every obscure renal lesion the possibility of its being due to fused kidney. It will be conceded to be an irrefutable fact, however obvious the statement may appear at first glance, that in order to diagnose a certain pathological condition one has to bear in mind the probability of its existence. Where, like in my case, an otherwise inexplicable incongruity exists between onset, duration and gravity of clinical symptoms, by which my young and robust patient was seized quite suddenly, and which in such intensity are rarely observed in uncomplicated nephrolithiasis, the possibility of horseshoe kidney should at least be taken into consideration, and investigations, carried on with that view in mind, might, occasionally, lead to diagnostic success.

CASE III.—*Double bladder in a prostatic; ascending pyelonephritis.* A man of seventy-three came under hospital observation on account of frequent and painful urination which had started about four years before and gradually had increased to almost unbearable intensity. Physical examination revealed mitral insufficiency and arteriosclerotic changes, symptoms of urosepsis; irregular temperature between 99° and 101° F., drowsiness. The bladder contains about 120 c.c. of very cloudy residual urine, showing microscopically abundant pus, degenerated small round epithelial cells and a number of hyaline and granular casts.

Prostate per rectum moderately enlarged. Two hours' phthalein output about 30 per cent. Cystoscopy, which was at first impossible on account of severe bladder irritability, when finally feasible, showed an irregular sphincter, a trabeculated and cystitic bladder wall, and, with the beak of the Nitze cystoscope pointed upward, on the posterior bladder wall, a diverticular opening, measuring about $2 \times 3$ cm.

The patient's local symptoms gradually improved under appropriate treatment, and successive pyelographic exposures, made at

FIG. 4.—Skiagraph of horseshoe kidney, showing a calculus on each side.

FIG. 5.—Double bladder in a prostatic.

regular intervals, demonstrated a gradual increase in the diverticular sac and a widening of its communicating opening; the pyelogram finally revealed the shadow of the bladder cavity, the contour of which presented several grotesquely shaped protuberances (diverticula), and which by a broad communicating opening was separated from the apparently larger bell-shaped upper cavity (Fig. 5).

Meanwhile, the patient's general and local condition had materially improved; urine showed microscopic absence of casts, two hours' phthalein had increased to over 60 per cent., twenty-four hours' urea ranged between 25 and 30 grammes. The operative removal of the upper vesical sac was, therefore, decided upon.

*Operation.*—In gas-ether narcosis the bladder was opened suprapubically; by means of a forceps, introduced through the diverticular opening, the upper sac was grasped, and easily inverted into the bladder proper; it was then resected over a clamp and its edges were stitched by several rows of catgut sutures. Closure of bladder and suprapubic incision around rubber tube.

Dr. Ophüls' report upon the histological examination of the resected sac was as follows:

> Sections show wall of fibrous tissue in which there are some strands of involuntary muscle. The inner layer is formed by more cellular and vascular connective tissue which is extremely hyperæmic and infiltrated with leucocytes. The inner surface is partly covered with stratified epithelium. In wall several small arteries with very marked endarteritis.

The post-operative course was eventful and complicated; aside from reappearance of pyelonephrotic symptoms, bronchopneumonia and a painful phlebitis set in; finally, though, after a very slow convalescence, the patient made a good recovery.

Six months after the operation, the patient urinated at regular intervals, about every four hours; urine fairly clear, the bladder contained about 60 c.c. residual urine.

The literature contains but scant references upon duplication or multiplication of the urinary bladder. Arthur Strauss [20] reports the case of a man of twenty-nine in whom, on suprapubic cystotomy, three separate bladder cavities were encountered, two smaller ones of the size of a pigeon egg, and a third one, lying beneath the two smaller cavities, revealing a capacity of 300 c.c. Both smaller cavities had, like the upper cavity in my case, no trigone and ureteral orifices. Gueterbock [21] mentions a case in which multiplication to five urinary bladders in the same individual was observed. Especially in women double bladder was often observed in connection with duplication of other organs of the urogenital tract.

Englisch [22] describes large congenital pockets of the bladder (Blasentaschen) similar in form to the upper cavity of my case; their differentiation from diverticula (Blasenzellen) is based upon the structure of their walls, which, besides mucous membrane, may contain one or all muscular strata of the bladder proper. According to Kathelin and Sempé [23] the true double bladder originates from the symmetrical anlage of the allantois and produces forms like those described by Rose,[24] Schatz,[25] and Woelfler,[26] where both vesical cavities are entirely separated, possessing separate ureters and an internal meatus leading to a separate urethra.

I can find, however, no record of a case like mine, of a vesical pocket or diverticulum presenting such strikingly symmetrical features in size and configuration and thus at once producing the aspect of vesical duplication. The wall of the excised viscus possesses, besides that, the histological structure of the bladder-wall. For these reasons, therefore, and especially for practical purposes, my case deserves to be designated as double bladder.

CASE IV.—*Congenital diverticulum of the bladder, hypertrophy of prostate, chronic cystitis.* A man of fifty-eight came under hospital observation with severe cystitis and uroseptic symptoms. He had suffered for some time past from urinary disturbances and at times had noticed blood in his urine. His present illness had been ushered in by a severe cold. Physical examination was negative, kidneys not palpable. Prostate per rectum considerably enlarged. The patient suffered from almost constant and most distressing tenesmus resulting in continuous dribbling. Urinalysis: Very cloudy urine, containing mass of microscopic pus. Bladder capacity about 40 c.c. with 15 c.c. of residual urine, presenting the appearance of pure pus.

After long and painstaking preparatory treatment of the bladder it was only possible to obtain momentary cystoscopic glimpses which revealed a moderately trabeculated bladder wall and the fairly normal outlines of the sphincter, while inspection of trigone and fundus was frustrated by almost instantaneous clouding of the irrigating fluid.

These urinary symptoms and cystoscopic findings seemed to point as taking their origin from a renal focus, and all efforts were, therefore, concentrated towards effecting bilateral ureteral catheterization. When, after many futile attempts, this was finally performed, clear and microscopically and functionally normal urine was obtained from both kidneys, thus proving by exclusion the vesical character of the condition.

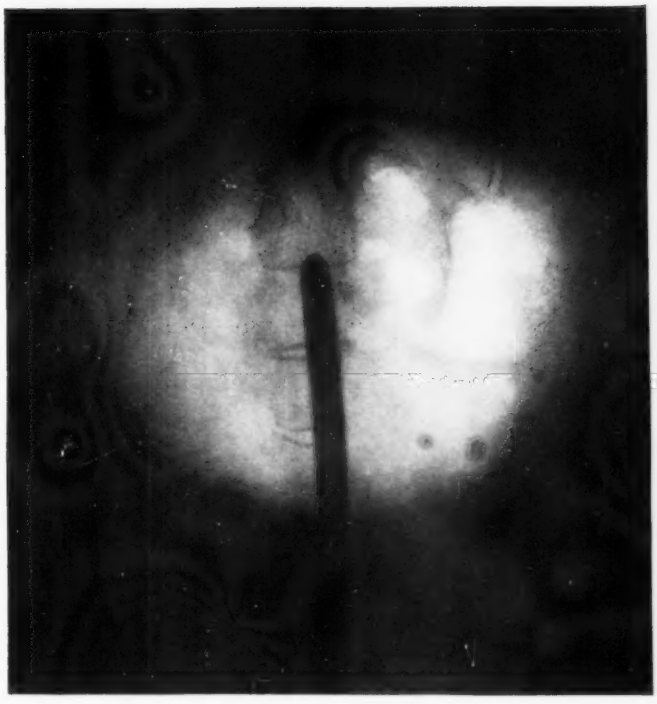

FIG. 6.—Congenital diverticulum of the bladder.

The existence of a diverticulum, as the cause of the condition, seemed now to be obvious, but repeated collargol cystography, made at this time, proved futile as regards diagnostic results, since the injected silver salt was almost immediately expelled from the irritable bladder. Finally, a cystogram obtained after filling the viscus with oxygen demonstrated a large diverticular sac (Fig. 6).

By methodical dilatation treatment bladder capacity gradually was increased, until cystoscopic demonstration of the diverticular opening was feasible; it was found to be located at the trigone, a little below and to the left of the right ureter, and its diameter was about $2 \times 2.5$ cm.; the depth of the sac was 5 cm., as ascertained with the tip of a ureter catheter.

The patient refused operation and left the hospital with a bladder capacity of over 150 c.c., and his local symptoms considerably improved.

The case deserves to be reported in this connection on account of its unusual diagnostic features; viewed from this angle, the observation furnishes an instructive contribution to the difficult chapter of the differential diagnosis of incipient prostatism and congenital diverticulum of the bladder.

The important lesson to be derived from the study of the small number of cases, grouped together in this communication, may be tersely expressed in the following appeal to the urologist: In every severe and etiologically obscure lesion of the urinary tract, presenting unusually difficult diagnostic features, consider the possibility of an anomaly of congenital character to be the underlying or complicating factor.

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# NOTES ON INDICATIONS IN KIDNEY SURGERY

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It seems that in no other field of kidney surgery one has to be so careful about the operative indications as in cases of floating kidney. In the first place it is known that the floating kidney in the majority of cases is only one of the conditions due to the general asthenia of the fibrous system supporting the inner organs, and it is obvious that the remedying of only a single instance will not relieve the number of symptoms due to a general enteroptosis. Nephropexy ought only be resorted to after it is ascertained that the most annoying symptoms are due to the abnormal mobility of the kidney, and that by putting the patient at rest and replacing the kidney these symptoms remain subdued. Even then this operation should only be undertaken if all other non-operative measures have failed to furnish relief; such measures are fattening up of the patient, resistance gymnastics, retaining pads. The prognosis has to be made with great caution, because, although the anchoring of the kidney should turn out to be an orthopædic success, the relief may be not a complete one. It is known that in floating kidney there may periodically occur a dilatation of the pelvis and of calices producing regular attacks known to the profession as Dittel's crises; these attacks being based on the development of a temporary hydronephrosis. It is a matter of experience that these conditions may periodically recur, although the kidney was properly fixed and remained so; it therefore seems that in these cases this dilatation of the renal pelvis and the calices is due to a temporary paresis of the pelvis produced by nervous influences and not by mechanical obstruction, as kinking of the ureter. Therefore even a durable anchoring of the kidney may not be sufficient to do away with these attacks. More strict is the indication for operative steps in cases of floating kidney due to a trauma that jolted the kidney out of its fastenings. In these cases the results are almost universally satisfactory.

In cases of calculi in the kidney it may be stated in a general way, that the discovery of a concretion in the kidney is identical with the removal of it, except if the general condition of the patient determines him to be a poor surgical risk. Among the profession the tendency is growing firmer to remedy everything that is not normal. We know that all the internal organs are in a state of interdependence on each

other, they stimulate, they retard, they may stop the functions of each other.

There is no way of determining at what date an abnormal condition will interfere with the coextensive function of the afflicted organ. Consequently, the question of indication for the removal of renal concretions simmers down to the question of immediate interference or of postponing it up to a time that is deemed desirable by the surgeon for reasons of general condition. It may be a subject of discussion, whether in a given case infection and inflammation or the concretion was the primary instance; but if once a calculus is formed, then there remains no doubt that this foreign body will be a constant source of irritation, and, especially if movable and raw of surface, may lead to considerable traumatism. That concretions are apt to grow constantly by apposition is another factor to be taken in consideration.

The statement that some concretions are discovered accidentally only does not mean much, because if there would not have been any symptoms, no X-ray picture would have been taken. The urgency of the indication will be determined by the character of the symptoms. If the suffering of the patient is frequent and intense, we will attempt early relief, if movements are apt to produce attacks we will try to prevent further traumatism to the kidney, the occurrence of which is proven in an objective way by the appearance of blood in the urine; the finding of pus and of formed kidney elements in the urine will appeal to us as an incentive for early operation, because it is significant of a progressive destructive process in the kidney.

In this way a large stone on account of its being immobile may give latitude to the time of operation, while a small movable stone will call for the earliest intervention feasible.

At the present time we are in position to be rather liberal with our indications for stone operations on account of the improvement in our operative methods.

We know now that most of the concretions may be successfully removed by the opening of the renal pelvis only, thus avoiding any damage to the secreting parenchyma of the kidney; even if we have to resort to a splitting of the parenchyma the method of fat transplantation, which I am practising to great satisfaction, deprives the nephrotomy of all its terrors, among which the post-operative hemorrhage was most prominent.

I would like to dwell a little on the ureterotomy—the opening of the ureter for the removal of stones. I am convinced that in this class of cases the utmost conservatism is warranted. It is a matter of ex-

perience that most of the ureteral concretions eventually pass spontaneously into the bladder; it is an established fact that in the majority of instances a ureteral concretion may be brought down into the bladder by the simple expedient of introducing a ureteral catheter into the ureter, pushing the catheter up to the stone, and by injecting some lubricant.

At the same time it must be kept in mind that the exposing of the abdominal part of the ureter is always an operation of great dignity; it is a not infrequent sequela of this operation that the exposure of this organ leads to formation of adhesions and of fibrous tissue around the injured part, which in turn may kink or compress the ureter to such an extent that the pertaining kidney is put out of activity. To this has to be added that the exact diagnosis of a ureteral stone quite often will meet with serious obstacles. Even the employment of the shadowgraph catheter, introduced by me in our diagnostic armamentarium, does not always protect one from errors. I repeatedly saw very competent surgeons perform a very lengthy operation without being able to find the supposed stone. The ureterotomy therefore has to be restricted to the most cogent indications, as which have to be quoted persistent reflectoric anuria or signs of urinary sepsis. If a ureteral stone becomes impacted inside of the vesical end of the ureter an attempt may be made in females to massage it out of the ureteral end into the bladder by bimanual manipulation. If that turns out to be a failure the ureteral mouth is split and the concretion extracted either by means of endovesical intervention (operative cystoscope) or after the interior of the bladder has been exposed by suprapubic cystotomy.

Bacterial invasion of the kidney will become an object of surgical attention as soon as an inflammatory involvement of the parenchyma is recognized. There may be an argument as to the time of operation and as to the extent of the intervention, but it must be asserted that only in the minority of cases a so-called spontaneous cure will occur. Even if that should be the case, it must be taken into consideration, that this thickening of the exudate and the final obliteration of the focus by calcification or by fibrous sclerosis is only obtained by the more or less extensive loss of the renal parenchyma, while a timely operation may have helped in confining this destruction to narrow limits. Some observers claim that it is best to tide the patient over the time of the acute attack and to operate during the cold period, giving the local and general immunization a chance to fortify the system. While this contention is still a matter of diversified opinions, it remains a fact that certain kinds of renal infections are of such a character as to

form a menace to the life of the patient if not operated on at a very early date. Early operation will be indicated if we have to deal with a rapidly developing process progressing so fast that the life becomes endangered either by the involvement of the other kidney or because the system is so rapidily flooded with toxins, that the resistance of the patient is quickly consumed and death occurs on account of foudroyant sepsis. As leading symptoms marking a rapid progress of the destructive process are eminent, constant rise of temperature, repeated chills and the appearance of blood with the pus in the urine.

The constant rising of the temperature is due to the increase of toxins in the circulation; each chill marks the establishment of a new inflammatory focus, and the appearance of blood is significant for the progress of destruction. The item hemorrhage deserves a little discussion. It will happen that after the initial stage of the attack the blood will disappear out of the urine, but that does not mean that the hemorrhage into the kidney has stopped. The fallacy of such an assumption may be very easily proven. If in such a case the observer places his hand on the kidney region, exerting slight pressure, the blood will reappear in the urine and cystoscopic observation will demonstrate the emanation of liquid blood out of the pertaining ureter, as a rule preceded by a worm-shaped coagulum. The explanation of these phenomena is this: Constant and copious hemorrhage inside of the kidney will overdistend the renal pelvis, the ureter not being spacious enough to carry off the blood as quickly as it is effused, and an occasional coagulation inside of the ureter may add another mechanical obstacle. In this way the tension in the renal pelvis is increased to such an extent that its expelling power is annihilated, paresis of its walls setting in. The apparent cessation of the hemorrhage under such circumstances becomes another danger signal.

We know that if infectious exudates are under pressure and tension the danger of general sepsis is increased, therefore, if during an acute attack a kidney becomes distinctly palpable, although not being considerably enlarged, the proof is furnished that the contents are under high tension, and immediate relief is indicated.

The findings after having exposed such a kidney are rather impressive: The whole perirenal tissue is œdematous, the surface of the kidney is punctured by innumerable subcapsular hemorrhages, the pelvis presents itself as a livid sac, the ureter is distended to the utmost.

While these rather stormy kidney infections, discussed above, are due to the activity of colon bacilli or staphylococci, the invasion of a kidney by streptococci produces an entirely different clinical picture.

These streptococcus infections, however, are of such an importance as to render them worthy of some discussion.

Colon bacilli and staphylococci manifest their occupation of renal territory by the ample production of pus, and, if hemorrhage occurs at all, it is rather profuse.

The streptococcus infection of the kidney leads to hard infiltration of the renal parenchyma, and the production of pus is negligible, the hemorrhage of an occult character.

The presence of such an infection announces itself by the appearance of œdemas in various parts of the bodily surface, appearing in one place, then disappearing there and establishing themselves in some other location; in the early stages such œdemas will also occur in the muscles of the eye and in the background, leading to minor disturbances in the sight. The urine contains albumen, almost no pus cells, but early hyaline and granular casts appear; the effusion of blood into the renal parenchyma, though red blood-corpuscles may be very scant or entirely absent, is revealed by the appearance of large round cells, stained yellow by the products of the breaking up of red cells.

The diagnosis of the streptococcus infection of the kidney is very important, because if no surgical aid is furnished, the patients invariably become blind in the further course and finally succumb. The oculists assert that the ocular changes in such cases may be differentiated with certainty up to the final period from the classic symptoms of albuminuric retinitis due to non-bacterial parenchymatous nephritis. Therefore, if fleeting œdemas occur, if the urine contains albumen, hyaline or granular casts and signs of occult hemorrhage, bacterial investigation of the kidneys with all the modern aid has to be undertaken forthwith. The establishing of the diagnosis of streptococcus nephritis calls for immediate surgical interference, nephrotomy or nephrectomy according to the qualification of the findings.

Operation in cases not too far advanced almost invariably will lead at least to a symptomatic cure, failure to furnish surgical relief means condemning the patient to blindness and eventual death.

Although personally I am able to report only temporary successes with the Edebohls operations, in cases of parenchymatous and interstitial nephritis, there are quite a few authors who assert to have achieved permanent results in some of their cases of this kind. There seems to be a theoretical possibility for qualifying the indications in such instances and to formulate the prognosis by midoperative observation.

The kidney is provided with certain safeguards to maintain an even

intrarenal pressure, although the pressure in the general vascular system may be abnormally increased. If now an excessive sudden rise in the blood-pressure occurs, there will be a danger that these safeguards may be overcome so that the intrarenal pressure will reach a degree apt to damage the secreting epithelia. The manifestation of such sudden vacillations may be regarded as forming an indication for operative interference in cases of nephritis.

Whether there exists an excessive intrarenal pressure can only be determined while the kidney is *in situ,* because any artificial dislocation of this organ will produce a secondary hyperæmia due to the stretching or twisting of the pedicle. Therefore after having exposed part of the surface of the kidney in question a little slit is made into the fibrous capsule, while the kidney is still *in situ;* if the parenchyma protrudes through this little incision then one is justified to assume a hypertension inside of the kidney and to expect some benefit from the decompression after Edebohls.

Metastatic suppurations in the fatty capsule of the kidney are quite often entirely overlooked or their symptoms are misinterpreted. This is regrettable, because an early diagnosis not only will serve to save the patient a great deal of suffering but timely interference is also important on account of the extensive destruction that after a while will result and on account of the danger of general sepsis, always present in suppurations in fatty tissue. It must be kept in mind that suppurations in the fatty capsule may become established independently from suppurations in the kidney, because the adipose capsule possesses arteries of its own able to import hæmatogenous infection. That accounts for the fact that adipose inflammation may be present, although the urine does not contain any products of infection. All these suppurations are accompanied by a rather high fever of an intermittent character, chills are not uncommon, pain in the kidney region is always present and very often the diuresis is considerably increased.

Special syndromes are dependent upon the localization of the infection and inflammation. In case the inflammatory exudate distends the fatty capsule at the posterior circumference of the kidney the pain and sensitiveness is very pronounced in the flank. If inflammatory infiltration occurs around the lower pole, then on account of the peritoneal irritation intestinal symptoms will appear in combination with exquisite sensitiveness around the lower pole.

Deep inspiration produces pain and paroxysms of coughing may be excited by involvement of the diaphragmatic pleura in case the inflammation extends upward. Pressure around the lower pole of the kidney

evokes reflectoric contraction of the abdominal muscles. If the abscess or the abscesses are located around the anterior surface of the kidney then the clinical picture may be obscured by vomiting due to compression of the ductus choledochus or the vertical part of the duodenum.

Any time that in presence of some known suppurative focus sudden pain in the kidney region is observed, combined with high fever, metastatic suppurations in the fatty capsule have to be thought of, especially if the diuresis is increased and if the otherwise normal urine contains pathogenic bacteria. That adipose inflammation may be present, although the urine does not contain any products of infection, is accounted for by the fact that pathogenic germs may be filtered through the kidney without exciting any inflammation in this organ, although producing inflammations in other structures into which they have been carried by the blood stream.

# BILATERAL POLYCYSTIC KIDNEY

## A CASE TREATED BY PUNCTURE OF THE CYSTS

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The following report of polycystic kidneys presents some features of interest: First, size of the kidneys; second, the hæmaturia; third, bilateral renal infection; fourth, result following puncture of cysts; fifth, death of patient's sister from renal insufficiency from double polycystic kidney.

Patient, a female, aged fifty-seven, was referred to me by Dr. E. Y. Davidson, of Washington. She had never been robust, but led an active life, earning her own living. Five years ago a hysterectomy was performed for some condition not ascertainable.

Dr. Davidson has seen her on several occasions for minor ailments, but never made a thorough examination until called in on March 10, 1915, because of patient being quite ill and passing bloody urine. A tumor was detected in left side and right side of abdomen.

Patient was seen by me, March 11, presenting the following conditions: She was anæmic, somnolent and appeared ill, running a temperature from 97° to 101°. The urine was very bloody, containing large clots. On abdominal examination a large mass was felt on the left side, extending above ribs and below a line drawn from one anterior superior spine to the other. The mass was nodular, the nodules varying in consistency and fluctuation being distinctly made out in some portions.

The whole mass was movable, although the patient complained of pain during this procedure. On the right side the same condition was present, extending lower down toward the pelvis, but the circumference was less than on left—on inspection the right side of abdomen was smaller than left.

On vaginal examination, a mass could be felt on right side fluctuant and movable; this suggested a cystic ovary.

Patient was cystoscoped and both ureters catheterized. Bladder showed evidence of chronic inflammation. Urine obtained from right side showed many pus cells and hyaline casts; a clot was present in left ureteral orifice, but the catheter was easily

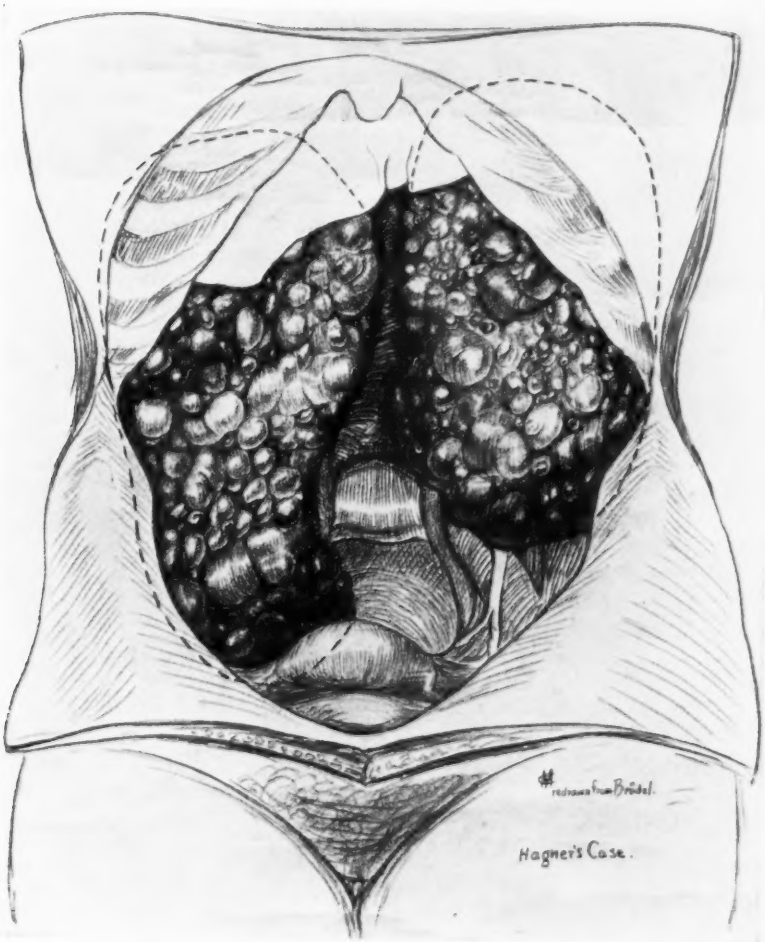


FIG. 1.—Bilateral polycystic degeneration of kidneys.

passed up 20 cm. into ureter—no fluid passed through catheter but washings of the catheter after its removal showed clots and clumps of pus cells. Culture from urine obtained from ureter showed colon infection. X-ray negative for calculi. Urine showed .55 per cent. of urea—8.08 grains in twenty-four hours. Phthalein tests showed 3 per cent. in seventy minutes.

Blood-pressure: diastolic, 130, and systolic, 190. A diagnosis of double polycystic kidney was made.

March 15, patient was operated on, under nitrous oxide and novocaine anæsthesia. An extraperitoneal operation was performed; an enormous polycystic kidney was exposed that measured 11 inches from pole to pole. The kidney was a mass of large and small cysts containing fluid of varying consistency, colored blue, green, yellow, pink and various hues of these colors. After puncture of the cysts the kidney shrank to nearly one-half its original size.

Cultures at time of operation from various colored cysts remained sterile. Patient made a good recovery from this operation.

On March 19, patient voided 990 c.c. urine; urea, 1.2 per cent.; urea retention was 3.6 grammes, phthalein test showed 14 per cent. the first hour and 14 per cent. the second hour as compared with 3 per cent. before operation. The right kidney was operated March 23, the same condition being found as on the opposite side, except that the kidney was much larger, extending from 2 inches above the ribs to floor of the true pelvis. This kidney measured 14 inches.

Several ureteral catheterizations were made and the pelvis irrigated; blood disappeared shortly after the first operation; slight recurrence was noted for a few days but stopped spontaneously.

The urea output varied from 9 to 15 grammes in twenty-four hours since the second operation, and the amount of urine from 1500 to 2000 c.c. Specific gravity, 1012 to 1015; the phthalein output has not been higher than 14 per cent. first hour and 16 per cent. second hour.

From March 15, the time of the first operation, all the symptoms of the patient improved. This continued until about May 1, when she began to fail, death occurring on June 2. The patient lived about two and one-half months after the first operation. I cannot help but feel that the puncture of the cyst prolonged her life. It is really remarkable how these patients can live at all with the small amount of kidney structure that they appear to have, and I think this will be seen when the kidneys are examined. The autopsy was performed by Dr. Lindsay and is as follows:

Body of white woman. Poorly nourished. External examination negative except for operative wounds. Chest negative. Heart slightly enlarged. Valves competent, slightly thickened.

Abdomen: Liver and gall-bladder negative.

Stomach negative. Intestines negative. Pancreas negative. Spleen negative. Both kidneys very much enlarged and polycystic. A number of the cysts had been punctured at operation. Only a few small areas of kidney structures were evident on section. The entire mass otherwise being made up of cysts containing pus, blood, or gelatinous material.

I have seen some of the work of Dr. Fred Lund, of Boston, along the line for which this patient was treated. Some of his cases after puncture of the cysts have been very much improved and several of his cases are alive two to three years after this operation. The cases, however, that I have seen him operate on have never been as extensive as this one.

This disease affects women more frequently than men. In Seiber's tables, in 198 collected cases there were 116 females and 82 males. Polycystic kidney is a rare disease. Preitz, on examining the records of the Keil Institute, found among 10,000 autopsies only 16 cases of polycystic kidney. In the Boston City Hospital in the records of 2,429 autopsies, occurring during the last ten years, there were ten cases.

The cysts are closely packed together and invade every portion of the kidney. The walls of the cysts are usually very thin, and inside of them are sometimes seen the remains of septa which mark the places of coalescence of neighboring cysts. The fluid varies in color as described in this case.

The kidney substance between the cysts is compressed and is fibrous and hyaline in character. Cysts of the liver have been associated with this condition of the kidney.

The pathogenesis of polycystic kidney is involved in great obscurity. It would appear that the disease in the adult and the infant is the same, yet it is hard to explain why the disease is not found between infancy and twenty-one years of age. The cysts in the adult appear to develop in large part in the convoluted tubules; this appears to be the case from the fact that in the slighter forms of the affection most of the cysts are found in the cortex.

The following theories have been evolved to explain the pathogenesis of polycystic kidney in the adult: First, the theory that the process is new growth; second, that the process is a result of inflammation and sclerosis of the interstitial tissue between the tubules; third, that the process is due to malformation and consequently must be congenital; and fourth, there are some who combine these theories and who

would explain the origin of polycystic kidney as the result of both malformation causes and subsequent tumor formation.

Malassez first conceived the theory of new growth, but Brigidi and Severi believed that the cyst contents were nothing more than the protoplasm of the epithelial cells fused together. They thought that they could observe nuclear division of the cells. They also thought that they could see young elements in the tubules and in the smaller cyst cavities. They compared the affection to ovarian cystoma. Ritchie was of the opinion that the process was one of new growth, but he thought that the disease in child and adult entirely distinct, believing that the adult cystic kidney is to be classed with the adenomata, while the congenital variety should be considered an error in development. Virchow believed that the cysts were true retention cysts and that they resulted from occlusion of the urinary tubules in consequence of inflammation of the interstitial tissue in the papillæ of the kidney. This view has been entirely abandoned, this inflammation being seldom found in infancy and is almost never seen in adults. The interstitial inflammation is now regarded as a sequence of the disease and not a cause.

The theory that the disease is in all cases congenital, and is in the nature of a malformation, has many adherents. The fact that it occurs so often in members of the same family suggests some intrauterine influence.

If we examine into the embryology of the kidney we shall see that there is good reason for supposing that malformation causes may be in part at least the origin of the condition. Huber has definitely shown that the fully developed tubule, that is, from its beginning in the glomerulus to its exit in the renal pelvis, is in the first instance formed from two separate structures. In early embryonic life there is formed a renal vesicle and a primary collecting tubule. The vesicle is situated at the outer side of the tubule. Later union takes place between two structures with the formation of a single canal. It is easy to see that if union failed to occur a cystic condition might result in the tubule which did not have an outlet.

The most plausible explanation seems to be that the disease may originate in consequence of embryonic malformation and that subsequent neoplastic formation takes place. The interstitial changes of the compression caused by the cysts themselves still further tend to augment the size of the cysts.

I wish particularly to bring out the fact that probably all polycystic kidneys are bilateral.

Dr. Barnett, of Fort Wayne, Indiana, a few years ago, collected a series of polycystic kidneys. He was especially interested in, and believed in, a unilateral disease in some cases. There were quite a number of men reported cases of unilateral disease, but among those that reported unilateral cases were invariably those that had had one or possibly two cases—the men with a larger number of cases, such as the Mayos, reported 20 cases, all bilateral. This is true also of the clinics at the Hopkins and at the New York Hospitals. Two of my friends who had reported cases on which they had done a nephrectomy for supposedly unilateral polycystic kidney, afterwards found that the patients had bilateral disease, so I feel that we can safely say that all cases of polycystic kidney are bilateral, and from results with Dr. Lund's cases, I think the only surgical operation we are justified in doing is puncture of the cysts.

# A CONTRIBUTION TO ECHINOCOCCUS DISEASE OF THE KIDNEY

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and

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In reviewing the literature of echinococcus disease of the kidney and adding one case thereto, it is not our intention, nor is it within the scope of this paper, to discuss the zoological distribution, the life cycle, etc., of this very interesting little tapeworm (*Tænia echinococcus*).

With the exception of Nicaise's two very valuable contributions, namely, *Thèse de Paris,* 1904–1905, *Archives générales de Chirurgie,* iii, 1909, p. 453, the literature is very fragmentary and, for the most part, from those countries in which echinococcus disease is much more frequent than in ours. The contributions from the North American hemisphere have been very few indeed, and, for this reason, we have deemed it wise to call attention to the possible existence of this disease in the diagnosis of those unusual and obscure conditions met with from time to time in the region of the kidneys. Nicaise (*Archives générales de Chirurgie,* iii, 1909) collected 402 cases, but neither tabulates nor lists them by reference. Hence, we have tabulated and referenced, so far as possible, these cases, 43 in number, appearing in the literature since Nicaise, *Thèse de Paris,* 1904–1905, in which he has given a most extensive bibliography. Of the 402 cases collected by him, 216 were treated surgically, 169 of which were treated by drainage, enucleation of the cyst or partial nephrectomy, with a mortality of 7.1 per cent. In the second group of 42 cases treated by nephrectomy, there was a mortality of 19 per cent. He advises the employment of the more conservative method and cautions against nephrectomy, since it is productive of so great a mortality. Kümmell, H., and Graff, H. (*Handbuch de praktischen Chirurgie,* vol. iv, 1914), state that echinococcus cyst of the kidney is rare and that there are 36 cases in which operations have been performed, which statement we interpret to apply to the German Rhenish provinces. He believes the cysts never to be multiple, and that, in spite of the compression of the cyst, some renal

tissue is always left. The only treatment considered is marsupialization, except in especially favorable cases which permit of a partial resection of the kidney followed by suture. He treated one case in this way, thereby shortening the convalescence.

While echinococcus cyst of the kidney may appear at almost any age, the youngest and the oldest patients that we have been able to find were three years and seventy-four years respectively. It is probably more frequent during middle life. It is more prevalent in females than in males and is said to attack the left kidney more frequently than the right. There is a wide variation among authors in the frequency in which echinococcus disease occurs in the kidney. Haynes states that it is 3.7 per cent. and that it is usually associated with echinococcus disease of other organs (ANNALS OF SURGERY, xxxvi, 1902). Vegas, H., Cranwell, D., state that in 920 cases of echinococcus disease, it occurred 20 times in the kidney, 2.1 per cent. (*Ctrblt. f. Chir.*, No. 3, 1904). Prat reports that in 471 cases of echinococcus disease, it occurred twice in the kidney, .42 per cent. (*Revista d. l. Hospitale*, Tome vi, No. 8, 1913). Ribera states that in 117 cases of echinococcus disease, it occurred 7 times in the kidney, 5.9 per cent.

The cyst may invade the whole kidney leaving no parenchyma, as in our case, or it may involve only a portion of the kidney, one pole or the other, or it may grow in the pararenal tissue only, compressing the kidney; furthermore, the cyst may or may not open into the kidney pelvis. The cyst is usually very adherent to the surrounding organs and the wall may be the seat of calcareous deposits. Upon its location, duration, size and involvement, the operative procedure necessarily depends. Echinococcus cyst has been reported in nearly all the different kidney conditions. Eberle and Celowski independently found it associated with floating kidney; Monad and Lanee, independently, in hydronephrosis. Houzel did a nephrectomy for echinococcus cyst in a solitary kidney; proved by autopsy. Juvara did a nephrectomy for hydatid of a left ectopic kidney. It has been associated with hydatid of the liver and other organs. Parlavecchio and Nicholich each report a case of hydatid cyst of the kidney rupturing into the bronchi and intestine with the discharge of daughter cysts through these ways as well as through the urethra. Hydatid cyst of the kidney is a slow-growing tumor extending over years and may present a varied degree of symptoms or none. From symptomless tumors accidentally discovered in the course of examination, the picture changes through the varied stages of pain and discomfort in the lumbar region to the severe

cases of renal colic, associated with hæmaturia or not, and with the expulsion or not of daughter cysts in the urine. These symptoms recur in attacks of greater or less severity from time to time. In those cases in which the cyst has opened into the renal pelvis with the expulsion of cysts or hooklets in the urine, the diagnosis is self-evident. On the other hand, when these symptoms are lacking, it is rarely possible to arrive at a correct diagnosis. The Weinberg complement-fixation test (*Annales d. l'Institut Pasteur,* No. 6, 1909) being positive, an associated eosinophilia with the presence of a tumor in the kidney region would point strongly to echinococcus disease of this organ; on the other hand, with a negative urine, cystoscopic and ureteral examination, with no palpable tumor, the eosinophilia and the positive Weinberg complement-fixation test (which is said to be present in two-thirds of the cases) is but of little assistance in localizing the hydatid even if it be present.

Welsh, Chapman and Storey (*Tranactions Australian Med. Congress,* 1909) believe the negative results in the precipitin reaction are inconclusive; that positive results are conclusive of hydatid invasion and are of very considerable clinical value; aspiration is cautioned against as a diagnostic procedure, since it is not infrequently followed by hydatid intoxication and incurs a danger of inoculation to other tissues, etc. The condition has been mistaken for ovarian cyst, appendicitis, pregnancy, floating kidney, hydronephrosis, pyonephrosis, etc. The cyst, not infrequently, undergoes pyogenic infection with the added symptoms of this condition. The disease is a surgical one and the ultimate result is necessarily prognosticated by the patient's condition, the extent of invasion, the surgical procedure pursued and the occurrence or not of post-operative hydatid intoxication.

F. Dévé (*Revue d. Chir.,* Tome xliii, Nos. 5, 6, 7) deals fully with hydatid intoxication both from the medical aspect and from the post-operative point of view. Briefly, he divides surgical post-operative hydatid intoxication into three classes: First, *benign*—hydatid fever, urticaria, etc.; second, *grave*—fever, urticaria, collapse, syncope, etc.; third, *fatal*—high and rapid rise of temperature, collapse, embarrassed respiration with nervous manifestations and death.

Aspiration or puncture is an unwise procedure for obvious reasons, besides, hydatid intoxication being more frequent after it than in other surgical procedures, there is danger of transplanting the parasite into neighboring tissues and causing the cyst to undergo suppuration from an added pyogenic infection. Intravenous injection of salvarsan has met with but little success and it is apt to cause the cyst to undergo

suppuration with the possibility of rupture and a fatal outcome. Enucleation of the cyst or partial nephrectomy, the method of choice, is applicable only in certain cases. Marsupialization and incision and drainage have the disadvantage of slow healing and the danger of secondary pyogenic infection. Bonamy (*Paris Chirurgical,* ii, 1910) cites a case in which he marsupialized the sac and in which carcinoma developed two years later, the patient dying from hemorrhage. On the other hand, either one is a short, quick operation and attended with a low mortality. Nephrectomy may be a very difficult operation, as it was in our case. The cyst is usually very adherent to the surrounding tissue, especially anteriorly to the peritoneum and the intestines. The peritoneum is so closely adherent that it is difficult to deliver the kidney and cyst into the wound without entering the peritoneal cavity and there is the added danger of causing injury to the intestines. It has the great advantage of a short convalescence and is much preferable to drainage in properly selected cases. Briefly, whether we shall do an enucleation, a partial nephrectomy, a marsupialization, a drainage or a nephrectomy, depends upon the conditions encountered at the time of operation. Should post-operative hydatid intoxication supervene, Prat advises the administration of adrenalin chloride 1:1000, which he found to neutralize toxic doses administered to dogs.

History of Case.—M. R. (Case History B. 8544), Italian male, aged forty-six years. Entered The Roosevelt Hospital October 20, 1916. Discharged December 16, 1916, with the following brief history. He is married, has two children living and well. Has had no previous acute illness, does not use alcohol, smokes very moderately, two or three pipes a day. Denies venereal infection. Six months ago he had an attack similar to the one for which he entered the hospital. Eight days before coming to the hospital, he had a chill and fever followed by pain and burning in the right kidney region. There was no nausea or vomiting and no urinary symptoms other than he thought the urine a little darker during the attack but had noticed no blood. Upon further questioning him after operation, we elicited the fact that he had observed small grape-like cysts in his urine from which he could squeeze watery contents. Had we obtained this statement before operation, a correct diagnosis should have been made. The physical examination elicited slight tenderness over the right kidney; no mass could be felt. His fever reached 101° upon the first two evenings and then remained normal until after operation. White blood-cells, 9400; polymorphonuclears, 72 per

cent.; large lymphocytes, 12 per cent.; small lymphocytes, 11 per cent.; eosinophilia, 4 per cent.; basophiles, 1 per cent. The X-ray findings were negative. The urine was normal except for a few pus-cells.

*Cystoscopic Examination.*—The bladder urine very turbid, the last portion by catheter being thick pus. Bladder mucosa markedly congested. Bladder tolerance very poor, the bladder holding only a small quantity of fluid, about 4 oz., and even this small amount caused intense straining and desire to urinate. Catheter passes to the left pelvis very easily. Flow of urine began immediately; normal as to rate and character of flow and clear in gross appearance. Catheter passes to right pelvis very readily. No flow of urine observed. Several catheters used, all with the same result. Fluid injected into the right pelvis to start the flow came back very turbid but nothing else was obtained. The urine from the left kidney practically normal. The fluid from the right kidney contains large number of pus-cells. Further examination to confirm finding on the right side advised (October 23, 1913).

Findings exactly the same as on previous examination. No flow obtained from the right side except the return of the small amount of fluid injected to start siphonage. The pus in the urine, the congested bladder mucosa, the intolerant bladder suggest the presence of an infected kidney on the right side. Kidney probably entirely destroyed. Left kidney performing entire renal function.

*Operation* (October 28, 1916).—By James I. Russell. Right nephrectomy through an oblique lumbar incision. The kidney, situated very high, was the seat of a large semifluctuating tumor with apparently very little, if any, kidney tissue left. It was quite adherent posteriorly and densely so anteriorly, the peritoneum could not be stripped from it without entering the peritoneal cavity. After freeing it anteriorly, without injury to the intestine, the mass could not be delivered into the wound. An attempt to empty it through a suction cannula failed, due to the thickness of the contents of the cyst. It was necessary to divide the twelfth rib to deliver the kidney into the wound; in doing which the pleura was accidentally opened. The ureter, which was tremendously enlarged and thickened to the size of my thumb, was freed as far as possible and divided, cauterized and ligated; the usual closure and drainage was established. He made a smooth and uninterrupted recovery, but now has a small hernia in the lower and anterior portion of his wound.

Upon removal, the kidney, much enlarged, measured 16 cm. by 13. About three inches of ureter, which is about 6 cm. in circumference, and very much thickened, was removed with the kidney. The kidney tissue had entirely disappeared and none

was recognizable microscopically. The whole kidney was occupied by a large echinococcus cyst with daughter cysts. The cyst communicated with the pelvis.

ABSTRACTS OF CASES REPORTED IN LITERATURE

MACKEY: Tumor of left kidney. Renal colic with expulsion of hydatids through urethra. Treated with turpentine. Improved. (*Lancet*, vol. xi, 1905, p. 601.)

SOREL, R.: Enucleation of a large hydatid from the kidney. A woman of thirty years. Kidney tissue closed without drainage. (*Archiv. Provinc. de Chir.*, xv, No. 6, 1906, p. 371.)

CATHELIN, F.: Suppurating hydatid of left kidney in a woman twenty-three years old. Nephrectomy and drainage. (*Bull. de la Anat. de Paris*, Tome 81, 1906, p. 550.)

SABRAZES and MURATET: Hydatid of left kidney in a man thirty years old. Operation. (*Gaz. Hebd. Sciences Med. de Bordeaux*, lxxvii, 1906, p. 277.)

BARADULIN: Tumor right kidney in a man forty-five years old. Renal colic with expulsion of hydatid cysts in urine. Drainage. The author had found altogether in the literature, 142 cases of echinococcus cyst of the kidney. (*Ctrblt. f. Chir.*, vol. xxxiii, 1906, p. 543, No. 19; *Monatschrft. fur Urologie*, lx, 1906.)

SANDVOSS: Of four cases of echinococcus observed by him, one concerned the kidney. (*Inaugural Dissertation*, Marburg, 1907.)

KAPSAMMER: Showed echinococcus sac and ureter at German Urological Society. (*Dtsch. Med. Wchschrft.*, 33, No. 43, 1907, p. 1802.)

GONZALEZ BRAVO: Tumor right kidney in a man twenty-seven years old. Renal colic with expulsion of hydatids through urethra. Nephrectomy. (*Revista Iberto. Americ. de Cicucias Med.*, No. 35, 1907, p. 18.)

DELANGLADE: Hydatid of kidney associated with hæmaturia and hydatids in urine. Incision and drainage. (*Soc. de Chir. de Marseille*, November, 1907; *Revue de Chir.*, 37, 1908, vol. iii.)

J. RIBERA Y. SANS: The author reports 117 cases of echinococcus cyst from Spain, including 7 cases of the kidney. Two operated upon by marsupialization; one operated upon by nephrectomy. (*El Siglo Medico*, May, 1908, No. 2840, p. 307; *Revista d. Med. Y. Chirug. Pract. d. Madrid*, 1908, p. 1029.)

PARLAVECCHIO: Large paranephritic cyst in a woman fifty years old, who, some years previously, had undergone spontaneous rupture into the bronchi and rectum. At operation, large cysts were also found in the abdomen which healed after incomplete evacuation. (*Ctrblt. f. Chir.*, 36, No. 49, 1909, p. 1702.)

RONTIER: Large hydatid of kidney in a woman twenty-eight years old. Transperitoneal extirpation of cyst wall. (*Bull. et Mém. Soc. de Chir. de Paris*, xxxv, 1909, p. 581.)

NEGRETE, C.: Reports a case cured by marsupialization. (*Revista Ibero Americ de Ciencias Med.*, Tome xxi, Madrid, 1909.)

WELSH, D. A.: Female, aged twelve. Multiple cysts of kidney.

CHAPMAN, H. G.: Male, aged twenty-six. Multiple cysts of kidney.

STOREY, J. C.: A negative reaction of the precipitin test is inconclusive, a positive reaction is conclusive of echinococcus invasion. (*Transactions Australian Med. Congress*, 1909, p. 385.)

BONAMY, R.: Large tumor left kidney region, pain, fever, pus in urine, in a man forty-one years old. Marsupialization of sac followed by cancerous degeneration, hemorrhages and death. (*Paris Chir.*, 11, 1910, p. 100.)

PFIHL: Left renal swelling in a man thirty-eight years old, associated with colic and retention which subsided with passing urine and hydatids. Drainage. (*Archiv. de. Med. Navale*, vol. xviii, 1910, p. 442.)

VERDELET, L.: Pararenal cyst in a girl of eight years, leaving kidney free, sac curetted and drained. (*Jrl. de Med. de Bordeaux*, 39, 1909, p. 7.)

EBERLE, A.: Tumor of right floating kidney in a woman of thirty-five years. Nephrotomy and drainage. (*Ctrblt. f. Chir.*, vol. xxxviii, No. 50, 1911, p. 1656.)

GARRE: Large tumor of right kidney in a woman twenty-four years old. Discovered accidentally, having given no symptoms. Nephrectomy. (*Dtsch. med. Wchschrft.*, xxxvii, 1911, p. 2057.)

MINETT, E. P.: Reported post-mortem, hydatid cyst of right kidney. (*Journal Tropical Med. & Hygiene*, April, 1911.)

DE SARTO: Pain in right lumbar region in a soldier, retention of urine which subsided with the expulsion of daughter cysts through the urethra. No operation. (*Giornale di Med. Milit*, lx, 1912, p. 6.)

GABSZEWICZ: Tumor in left kidney in a woman. Renal colic and fever. Nephrotomy. (*Ctrblt f. Chir.*, vol. xxxix, No. 16, 1912, p. 549.)

LOUMEAN, SABRAZÈS, MARTET: Left-sided renal colic in a boy of eleven years. Expulsion of hydatids through the urethra. Nephrectomy. (*Journal d'Urologie*, Tome xi, 1912, p. 105.)

BRÖSE: Tumor of left kidney in a woman sixty-five years old. Nephrectomy. (*Ztschrft f. Geb. u. Gyn.*, 70, 1912, p. 296.)

LOUMEAN, E.: Left-sided renal colic in a man. Expulsion of hydatids through urethra. Enucleation of cyst with partial nephrectomy. (*Gaz. Hebd. d. Sciences Med. de Bordeaux*, xxxiii, No. 4, 1912, p. 38.)

NICOLICH: Right-sided tumor in kidney region for twenty years in a woman. Five years ago serious lung affection, coughed up large number of hydatids. Hydatids in urine and in the stools. Drainage. (*Jrl. d'Urologie*, xi, 1912, p. 842.)

EDMUNDS, A.: Large tumor left kidney, woman thirty years old. Nephrectomy. (*Medical Press and Circular*, 95, 1913, p. 444.)

PLUYETTE, GAMEL: Tumor left kidney in a woman twenty-five years old. Nephrectomy. (*Arch. Provinc. de Chir.*, xxii, No. 3, 1913, p. 167.)

YEACI, E.: Tumor right kidney. Incision. Escape of hydatids. Drainage. (*Il Policlinico Sez. Prat.*, xx, No. 21, 1913, p. 743.)

JUVARA, E.: Left-sided tumor below umbilicus, misplaced kidney, Nephrectomy. (*Bull. et Mem. d. l. Soc. de Chir. de Paris*, xxxix, No. 3, 1913, p. 103.)

CUDARD: Tumor right kidney. Hydatids in urine. Marsupialization. (*Arch. de Med. et Pharm. Nav.*, Tome 100, 1913, p. 216.)

KRULL, J.: Right-sided renal colic, hæmaturia, expulsion of hydatids through urethra. No operation. (*Nederl. Tydschrift v. Geneeskunde*, lvii, 1913, p. 1950.)

DIAMANTIS: Left hydatid kidney. Male fifty-two years old. Hæmaturia, colic with expulsion of hydatids in urine. Drainage. (*Journal d'Urologie*, Tome iii, No. 2, 1913.)

PRAT, D.: Review of Hospital statistics of Uruguay, 1908 to 1912. Two cases of hydatid of kidney. (*Revista de los Hospitales*, Tome vi, No. 8, 1913.)

LONGO, L.: Large tumor of right kidney, girl of seven years. Marsupialization. (*Il Policlinico Sez. Clin.*, xxi, 1914, p. 176.)

HALAHAN, R. E.: Tumor of right kidney in woman twenty-three years old. Excision of cyst and suture of kidney. Drained. (*Lancet*, 1914, vol. xi, p. 1146.)

CARTA, MULAS, L.: Expulsion of hydatid membrane and daughter cysts in urine. Refused operation. (*Gaz. d. Orp.*, xxxv, 1915, p. 613.)

DOWNES, W.: Hydatid of left kidney. Male forty-nine years old. Nephrectomy. (ANNALS OF SURGERY, lxii, 1915, p. 628.)

# PRELIMINARY RENAL DRAINAGE WITH SPECIAL REFERENCE TO THE TWO-STAGE OPERATION ON THE KIDNEY

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It is indeed a rare privilege and high honor to offer a small contribution to this number commemorative of the life and work of Dr. Paul M. Pilcher, and I know of no subject which would more closely ally itself with the work that he has so splendidly done in recent years, than one dealing with the question of preliminary drainage. Its value in prostatic surgery for the relief of renal retention and absorption has been emphasized and its importance promulgated, in a great measure, through his unceasing efforts, until at present it is thoroughly established as the paramount feature in prostatic surgery.

Preliminary drainage of a diseased kidney before its surgical attack has, on the other hand, been dealt with very sparingly by the general profession, and has received no such heraldry as that dealing with lower obstruction. It is for this reason that a terse comment on this topic will be presented. I may have nothing novel to suggest to the urologist, but to the busy general surgeon who may not be so well posted on special affairs, it is possible that a discussion of this feature of renal surgery may be acceptable.

It appears that in the treatment of certain renal retentions and infections there is a close parallelism between the preliminary treatment before ultimate surgical attack upon the kidney itself, and of obstruction at the lower tract causing somewhat similar renal involvements, namely, the relief of such retention either by catheter drainage or by open operation.

*Ureter Catheterization.*—Almost everyone is thoroughly convinced that the ureteral catheter has a valuable application in the treatment of many types of renal disease. It seems to possess a therapeutic triad, namely: preparation, conservation and cure. In this communication its value as a preparatory measure will alone be dealt with, its importance in conservation and cure having been recently discussed in a previous article,[1] although one frequently encounters surprises in that often the method of preparation produces an apparent cure.

[1] Journal of the American Medical Ass'n., vol. lxviii, No. 9, March 3, 1917, p. 675.

Preliminary drainage by means of the ureteral catheter as a preparatory measure may be very effectively employed in unilateral infected hydronephrosis, occurring from one cause or another. The individual may be depleted from disturbance of rest on account of renal discomfort and absorption, and the other kidney comparatively good, but showing a toxic nephritis. In such cases, draining the hydronephrosis, either intermittently or by the retained ureteral catheter, will improve the patient's general condition surprisingly, relieve the other kidney of its strain, and allow its function to become restored to normal. Such individuals could be operated on, and usually are, without such preliminary drainage, but their convalescence and their whole course is decidedly better when they are preliminarily prepared. Another type of disease in which preliminary catheter drainage is very efficacious is acute unilateral pyonephrosis, due either to sudden blockings with mucus, pus, calculus, or otherwise, in individuals who are acutely sick and extremely toxic. Such processes we see frequently in diabetics and tabetics, where major surgery at best is often grave, and certainly under such circumstances, I have seen such patients who were extremely sick, very toxic, with large masses in the kidney region, running high fever, where the balance could be easily toppled, who were almost immediately relieved of their absorption by an indwelling ureteral catheter, and were soon ushered into such condition as to make surgical attack safe. It is really surprising, and indeed almost unbelievable what wonderful effect ureteral catheter drainage will have on these extremely toxic individuals. In practically all of them the other kidney improves in function, and the diseased kidney also, unless, of course, the lesion is an old chronic pyonephrosis. Indeed, some of the acute pyonephroses get symptomatically well under drainage, even though the kidneys had previously given the impression of being practically destroyed. Functional tests in some of these individuals had risen from practically nothing to near normal limits within a very short time. Such kidneys, of course, will usually show positive cultures, but at any rate the individuals have been made safe for surgery.

The ureteral catheter seems to have an application for bilateral renal drainage only to non-tuberculous renal retentions, and as far as the author's experience goes, chiefly to calculus pyonephroses particularly in patients whose combined function is extremely low, and who are uræmic from profound absorption. The ureteral catheter in such instances is extremely serviceable. A recent patient whose phthalein was almost unreadable, and who was so uræmic and so toxic that death seemed almost inevitable, improved sufficiently under

preliminary drainage and lavage with the ureteral catheter at repeated intervals, to be ultimately cured by a two-stage operation on either kidney.

*Two-stage Operation on the Kidney.*—It must not be understood that I am advising secondary nephrectomy as a routine method of choice. Naturally if a diseased kidney has a partner that is capable of maintaining its host's equilibrium and the diseased kidney is not so disturbed as to make its immediate removal dangerous, primary nephrectomy is the operation of choice, and is done with an exceedingly low mortality. In the author's experience it has been *nil* in a series of forty-two cases, but for a certain few, extremely ill individuals with either unilateral or bilateral involvements, the two-stage operation is unquestionably the wisest surgical move. It is very seldom in adults that we are compelled to do a secondary nephrectomy, but in children and in infants, whom we so frequently see in the St. Louis Children's Hospital, coming in with very large pyonephroses, extremely toxic, with high leucocytosis, high fever, and some so overwhelmed that fever is impossible, who look almost as though any surgical attack would be fatal, and certainly nephrectomy, preliminary nephrotomy has offered them their only chance. Quite a number of such children have been operated on in extremis without a death. The children, under gas anæsthesia, have their kidneys exposed through the lumbar incision and freely drained with tube drainage, within the kidney and around it, and contrary to custom, I have at the operation frequently freed the kidney somewhat from its surroundings. All the children have immediately improved and all have had their secondary nephrectomy in four weeks, usually two to three weeks, and only in one case has it been necessary to do an intracapsular nephrectomy. Within this time adhesions are delicate, the kidney small, and removal has been quite simple.

The two-stage operation serves its most admirable purpose in bilateral calculus pyelonephritis or pyonephrosis. With both kidneys almost completely filled with large coral stones, with the cortices greatly destroyed by inflammation, and the pelves having more or less retention, and whose combined function is extremely low, the removal of both stones at one sitting or even one of them will often be more than the individual can stand. As the author has had several extreme examples of this type of disease, he feels that the two-stage operation on each kidney is a method that should be more frequently used, even though it is so tempting to remove a branching calculus when it is palpated in the kidney. The findings in brief of a recent case exemplify the advisability of such a technic. A woman past middle life came in extremely

ill and uræmic, with vomiting, headache, œdema of the lower extremities, very pasty and sallow, with fever, chills, exhaustion; X-ray showed large coral stones in each kidney, function extremely low from each, a colon bacillus infection and a small amount of retention in each kidney. She was drained and her pelvis lavaged by means of the ureteral catheter on several occasions. Later the right kidney was nephrotomized, tube drainage to the pelvis through the cortex. Kidney was slightly freed and free drainage put into the kidney space. No attempt was made to disturb the calculus. About two weeks later the stone was removed. About a month later the other kidney was drained, two weeks the stone removed. The kidneys were not drained simultaneously, nor was either stone removed with the drainage, and it is unquestionably due to this that the patient's life was saved. After each one of these short and easily executed operations, the patient showed considerable reaction, and I am perfectly confident had any too much been done in either sitting, the patient would have died. The preliminary drainage of the kidney has the same effect as drainage of the lower tract, by relieving absorption, allowing the wound to wall off by granulations and lessening engorgement and hemorrhage, and naturally making the operation less time-consuming and less shocking.

The suggestion for the two-step operation on either kidney in this type of case is the main object of this brief discussion. My patients on whom this has been done are well, and even though their function is still low, but somewhat improved, they are relieved of their symptoms and toxæmia. and I feel confident had they not been given the benefit of preliminary drainage, and very little surgery at each sitting, the story would have been different.

# THE INFLUENCE OF THE VENOUS COLLATERAL CIRCULATION OF THE KIDNEY ON HYDRONEPHROSIS

AN EXPERIMENTAL STUDY

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(From the Laboratory of Surgical Pathology, Harvard Medical School)

I have already shown experimentally [1] that complete and sudden obstruction of one ureter by ligation results in hydronephrosis of the corresponding kidney. With few exceptions the degree of hydronephrosis varies directly with the length of time after ligation of the ureter (compare Figs. 1, 2 and 11), and, judging by the results seen in two dogs which were allowed to live 247 and 258 days, respectively, the hydronephrotic sac will continue to increase in size for a very long time.

In all of these cases the fibrous capsule of the hydronephrotic kidney is found to be overlain by a network of engorged veins not demonstrable before operation. In some instances this venous plexus shows remarkable development (Figs. 1 and 2*), while in others it is less apparent (Fig. 11). By injection with gelatine these veins are found to form anastomoses with others, notably the spermatic (or ovarian), the adrenal, and two or three lumbar veins posterior to the kidney (Figs. 1 and 2). It became apparent early in my work that there was a very intimate connection between the development of the hydronephrotic sac and the venous plexus, and, when the latter was absent or but poorly developed, there was generally a correspondingly small hydronephrosis. Lindemann,[2] in 1895, had already made this observation, but his evidence was based largely on microscopic evidence.

A consideration of the venous apparatus of the normal kidney will help to explain the phenomena observed. There arise on the surface of the kidney, innumerable clusters of venous capillaries, having a star-shaped arrangement (*étoiles de Verheyen*), each emptying into a central vein and thence entering the kidney by the interlobular vein. The fatty capsule of the kidney contains a rich plexus of veins and these empty on the one hand into the renal vein or one of its branches, and on the other directly into the kidney substance, either (1) through connections with the star-like capillaries of the

* Figs. 1, 2, 3 and 4 are from specimens obtained in a previous experimental work and have already been published.[1]

fibrous capsule or (2) by centrifugal veins which pierce the fibrous capsule and the renal cortex. The latter are to be regarded as accessory renal veins, able, at least in part, to assume the work of the renal vein (Téstut [3]). The anastomoses of the venous plexus in the fatty capsule of the kidney have been thoroughly worked out by Tuffier and Lejars,[4] who showed that obliteration of the renal vein might result in the formation of a collateral circulation whereby venous blood from the kidney would be carried back into the general circulation through this plexus by four routes. These are (1) the suprarenal and inferior diaphragmatic veins, (2) the ureteric and spermatic (or ovarian) veins, (3) the subcutaneous plexus of the lumbar region, and (4) the plexus which surrounds the last intercostal nerve and the ilio-inguinal and iliohypogastric nerves.

One of the earliest effects of sudden and complete obstruction of the ureter is the production of an intense hyperæmia and œdema of the kidney. The intrarenal pressure slowly rises by damming back urine which is being formed, and this in turn produces a slow but constant dilatation of the uriniferous tubules. This compresses the venous capillaries, especially those in the cortex, and serves to perpetuate the changes already started. At first only the venous capillaries are affected, but later the arterial circulation also becomes involved (Lindemann, *loc. cit.*). If then the venous apparatus both in the fat capsule and on the surface of the kidney is well developed, as, in my experience, it clearly is in the vast majority of instances, the anastomoses already described by Tuffier and Lejars (*loc. cit.*) will take up the work for which they were intended and carry on, more or less perfectly, the venous circulation of the kidney. If, on the other hand, as may occasionally happen (experimentally, once in 33 animals), this accessory venous circulation develops either not at all or but slowly, the secretion of urine soon ceases, hydronephrosis will not develop, and atrophy of the kidney will take place. The laboratory notes of the one instance in which this phenomenon was observed are as follows:

Dog. 5. Figs. 3 and 4. August 24, 1909. Young, black mongrel dog. Ether. Right ureter divided and ligated. Kidneys of equal size and of normal appearance.

October 18, 1909: Dog in perfect health. Wound healed *per primam*. Laparotomy. Right kidney considerably smaller than left, firm, normal color. ***Vessels of renal capsule not engorged.*** Ureter thickened, not dilated; left kidney has not changed in any respect.

November 20, 1909: Animal in good condition. Laparotomy. Right kidney about two-thirds its former size, abnormally firm in consistency, dark in color, ***capsular vessels not engorged.*** Ureter distinctly fibrous.

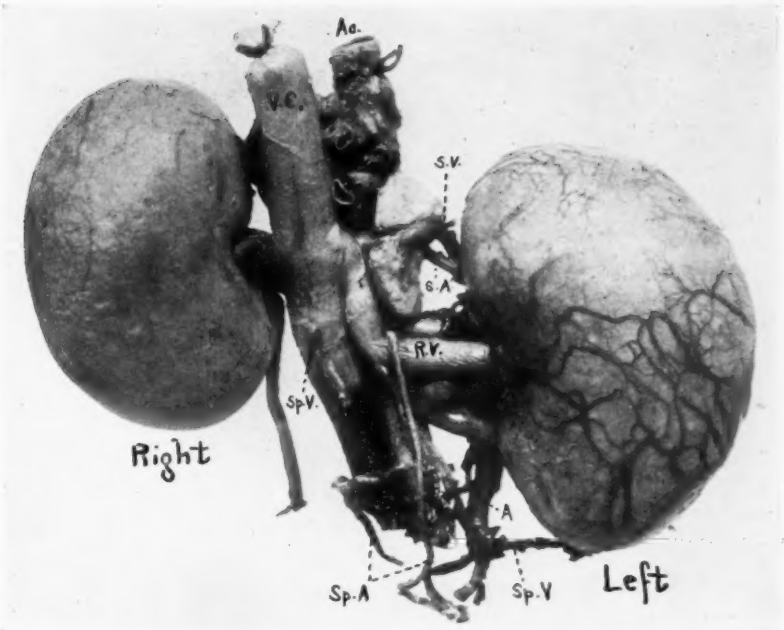


FIG. 1.—Dog 26; male. Eleven days after ligation and division of ureter. Left hydronephrosis. Anterior view. Injection of vessels. Nephroptosis on left. Tortuosity of left ureter, *A*. Note branch of spermatic vein, *Sp. V.*, going to lower pole of kidney, and suprarenal vein, *S. V.*, supplying upper pole; *V. C.*, vena cava; *Ao.*, aorta; *R. V.*, renal vein; *Sp. A.*, spermatic artery; *S. A.*, suprarenal artery. No engorgement of vessels of right kidney.

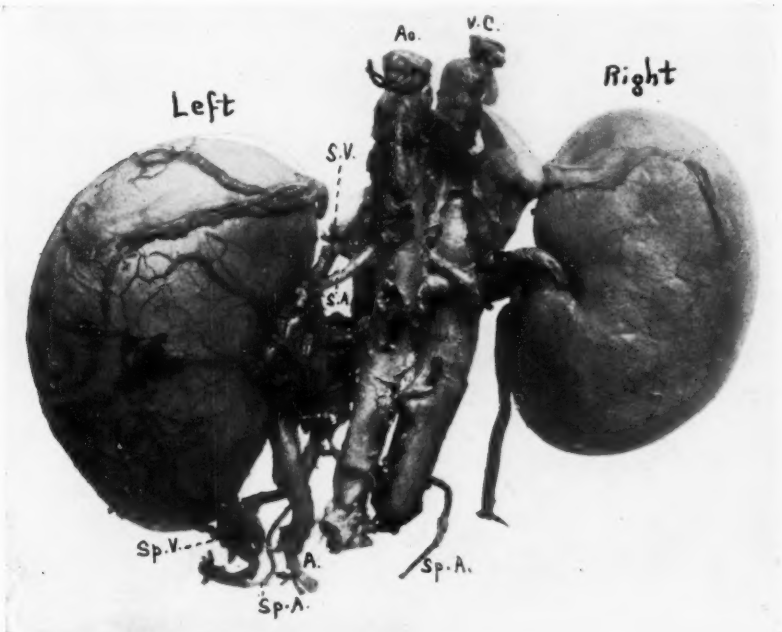


FIG. 2.—Dog 26; male. Eleven days after ligation of ureter. Left hydronephrosis. Vessels injected. Posterior view. Shows size, number and distribution of vessels on posterior aspect of kidney. Compare with anterior view, Fig. 1.

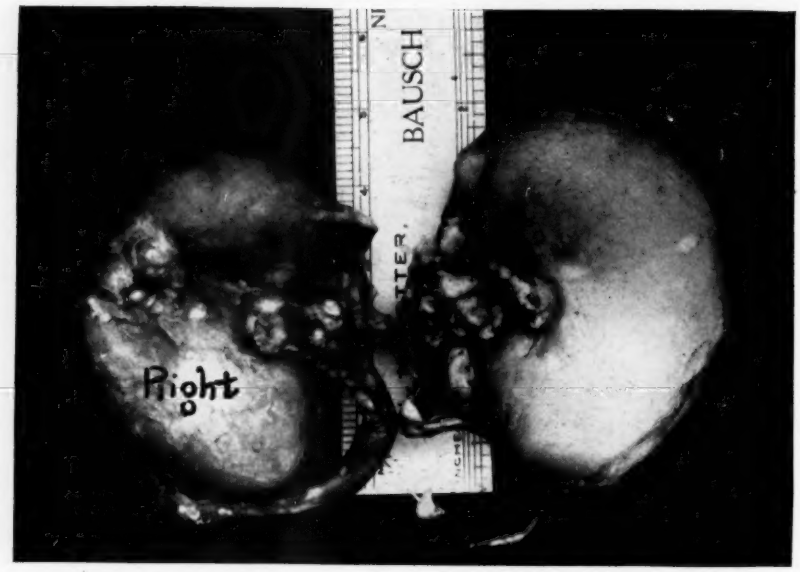


FIG. 3.—Dog 5. Eighteen weeks after division and ligation of right ureter. Compare with Figs. 5 and 7. In this case the veins of the kidney were undisturbed, but at no time did they show evidences of engorgement or of anastomoses so well shown in Figs. 1 and 2. Right kidney about one-third smaller than left, no dilatation whatever of ureter or pelvis.

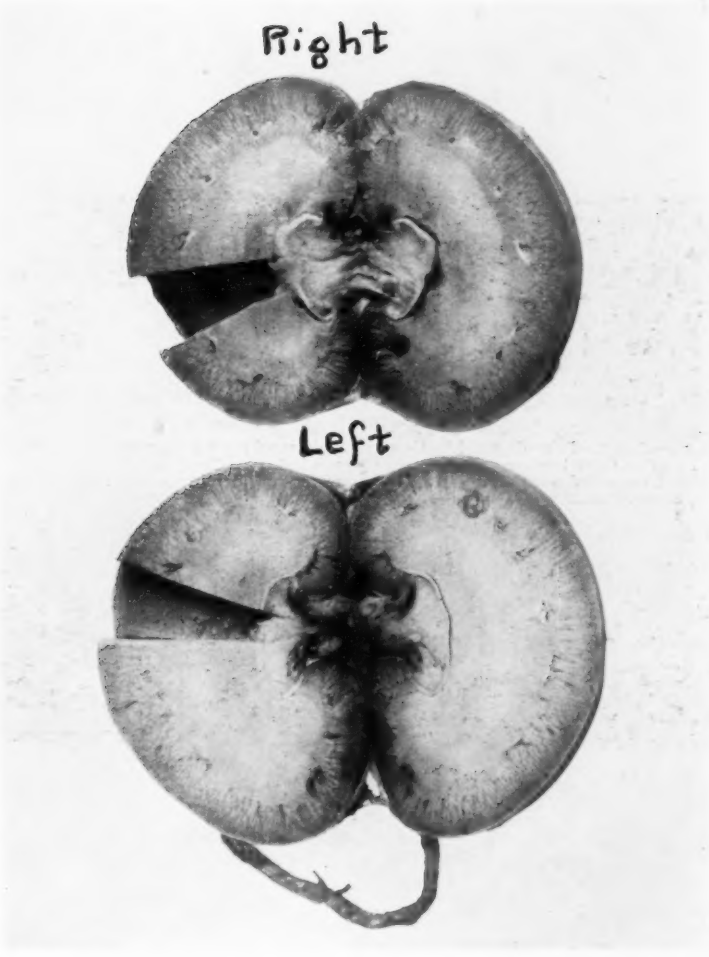


FIG. 4.—Section of right kidney shown in Fig. 3. Note the difference in size between it and the normal (left) kidney below. No dilatation of pelvis or of calyces. Renal substance infiltrated with fat and fibrous tissue and normal markings are almost entirely obliterated.

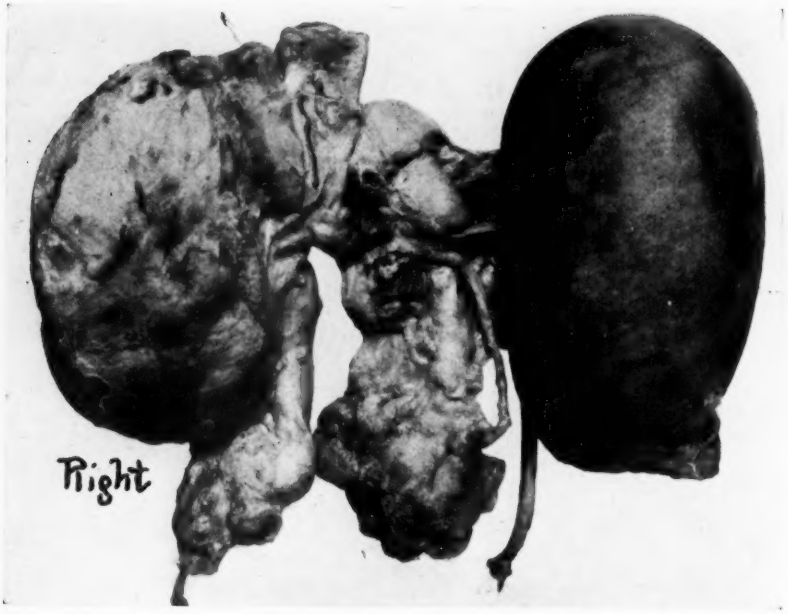


FIG. 5.—Dog 3. Fifty days. Ligation and division of right ureter and of spermatic, suprarenal and two or three lumbar veins posterior to the kidney. Considerable perinephritis. Right kidney about one-third smaller than its fellow, ureter considerably dilated, but no evidence of engorgement of capsular veins.

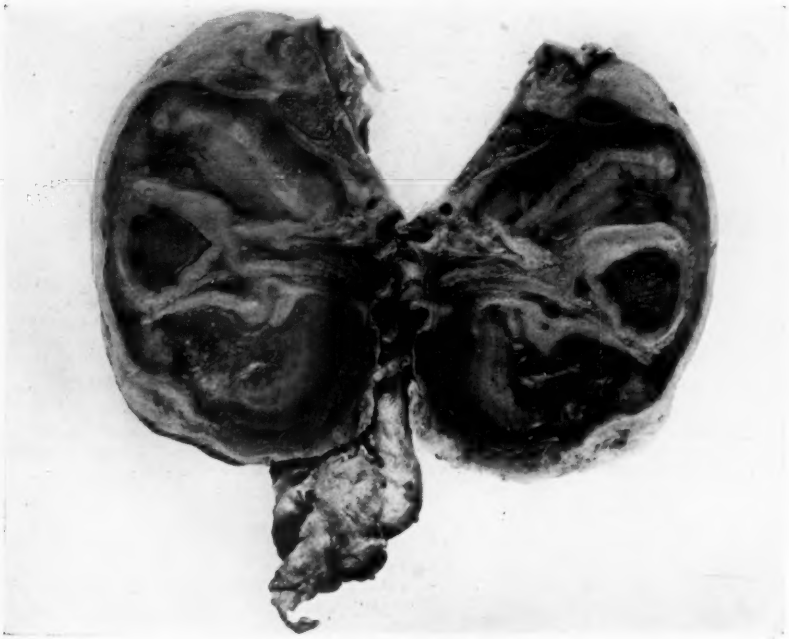

FIG. 6.—Section of right kidney shown in Fig. 5. No dilatation of pelvis or of calyces. Kidney substance is infiltrated with fat and fibrous tissue.

FIG. 7.—Dog 4, control. Fifty days. Ligation and division of right ureter. Capsular veins moderately engorged, ureter and pelvis somewhat dilated, moderate degree of hydronephrosis.

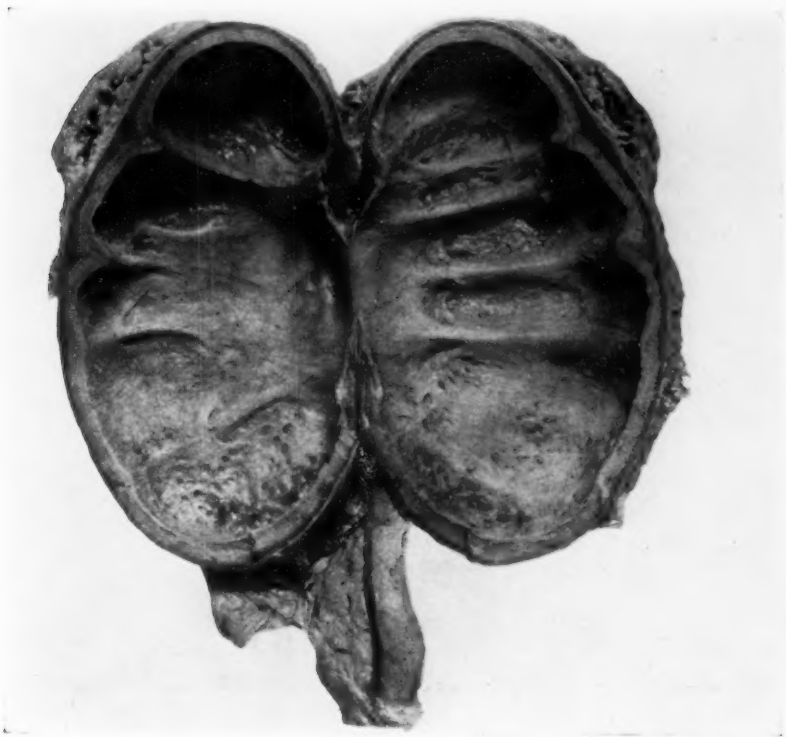

FIG. 8.—Interior of right kidney shown in Fig. 7. Renal cortex much thinned.

FIG. 9.—Dog 7. Fifty days. Ligation and division of right ureter and also of spermatic vein suprarenal vein and of two or three lumbar veins posterior to the kidney. Right kidney is much smaller than the left, but the pelvis and ureter are dilated. No engorgement of capsular veins of kidney.

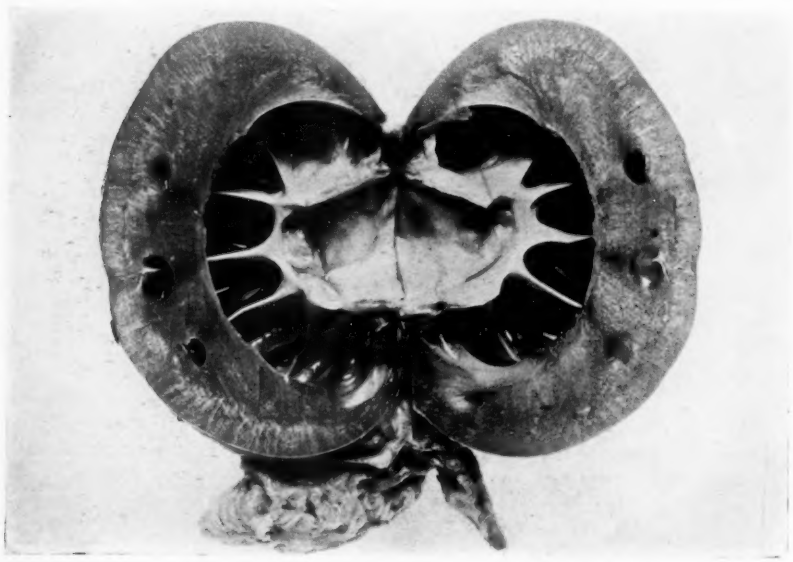

FIG. 10.—Interior of right kidney shown in Fig. 9. Moderate degree of hydronephrosis.

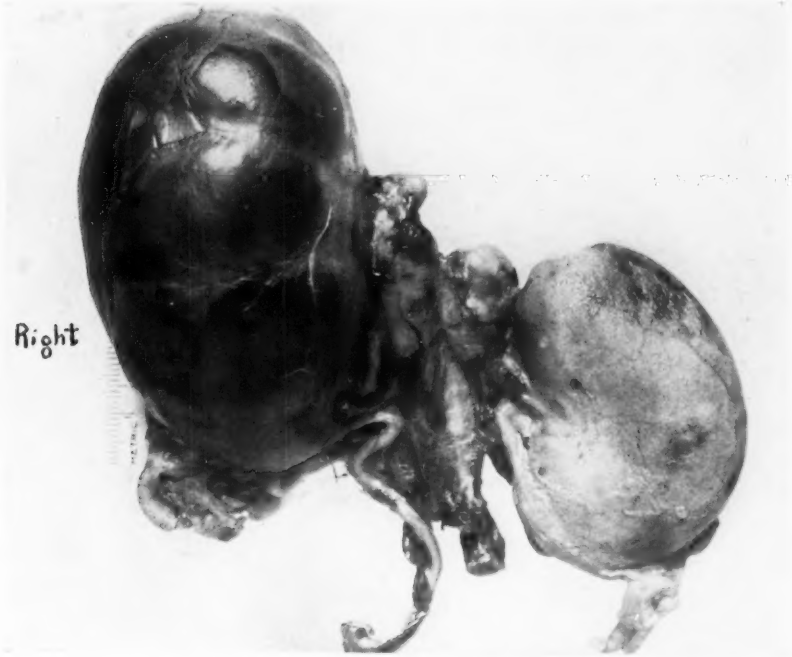


FIG. 11.—Dog 8, control. Fifty days. Ligation and division of right ureter. Capsular veins much engorged. Hydronephrosis.

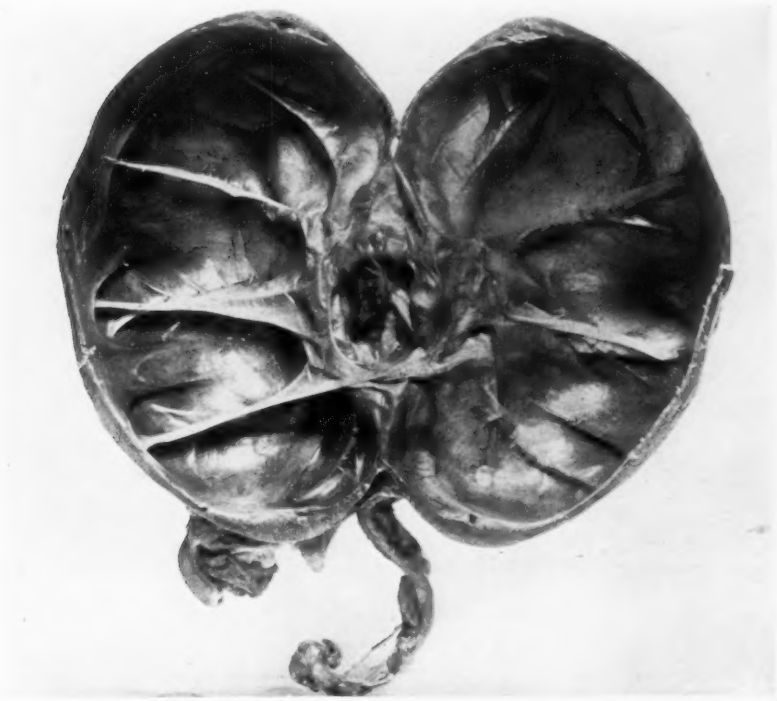

FIG. 12.—Interior of hydronephrotic kidney shown in Fig. 11. Renal cortex much thinned, pelvis much dilated.

December 28, 1909: In good health. Has gained weight. Laparotomy. Right kidney has not changed since last note, in size, color or consistency, but is about two-thirds size of left. No dilatation of its pelvis or ureter. Left kidney normal. Animal killed.

On section the right ureter is thick and fibrous, and contains a little grumous material. The kidney is fully one-third smaller than the left, pale, distinctly fibrous, its normal markings are obliterated, and there is no dilatation whatever of its pelvis. The latter contains a few cubic centimetres of thick, cloudy fluid of urinous odor.

Here, then, is an example of true renal atrophy, and it occurred to me at that time that if such a result would take place spontaneously it might also be produced artificially by preventing the formation of the venous anastomoses already described. I can find no evidence in the literature that this problem has been investigated before.

In the fall of 1914, through the courtesy of Professor E. H. Nichols, to whom I am deeply grateful, this work was undertaken in the Laboratory of Surgical Pathology at the Harvard Medical School. Four pairs of dogs were operated upon (one of each pair being used as a control). As the results in the first and third pair were entirely vitiated by sepsis and otherwise faulty technic, the laboratory notes of only the second and fourth pair will be given.

Dog. 3. November 13, 1914. Ether. Four-inch incision through upper border of right rectus muscle. Ureter isolated through an incision in overlying peritoneum, and divided about 2 inches below the kidney between 2 ligatures of No. 1 chromic catgut. The spermatic vein was then ligated and divided close to its entrance to the vena cava, and a small group of veins at the lower pole of the kidney, found by previous experience to anastomose with the spermatic vein, were also tied and divided. The suprarenal vein and a group of two or three lumbar veins posterior to the kidney were also ligated and divided, linen thread being used throughout. The abdominal wound was closed in two layers.

January 2, 1915 (50 days): Dog has been well. Sacrificed with strychnine.

Right kidney pale, size of plum, much smaller than before operation and smaller than left kidney. Considerable perinephritis. Ureter tortuous, moderately dilated. No demonstrable dilatation of pelvis. *No dilatation of capsular vessels* (Fig. 5). Left kidney is unusually dark in color, but otherwise seems normal.

On section (Fig. 6) the right kidney is found to be much smaller than its fellow, its pelvis and calyces of normal size and filled with a thick, grumous material. The kidney substance, especially the cortex, is extensively infiltrated with fat and fibrous tissue, and the specimen as a whole is quite comparable to that of Dog 5 (Fig. 4), occurring spontaneously in my earlier series of experiments. The pathology of these specimens is purposely omitted here as it is considered worthy of a special communication to be made later.

Dog 4. Control. November 13, 1914: Same technic as with Dog 3, but veins were not ligated.

January 2, 1915 (50 days): Dog has been in good health. Sacrificed with strychnine. Right kidney about one-third larger than left, elastic, pelvis and ureter dilated, *veins of capsule moderately engorged*, corresponding in their relation to the degree of hydronephrosis with my previous findings in such cases (Fig. 7). A section of this kidney, Fig. 8, shows typical hydronephrosis of moderate size.

Dog 7. November 24, 1914. Same technic as in Dog 3.

January 13, 1915 (50 days): Dog in good condition. Sacrificed with strychnine. Right kidney much smaller than left, *no dilatation of capsular vessels.* Considerable dilatation of the ureter, which is tortuous, and of the pelvis, which is largely extrarenal (Fig. 9). A section of this kidney (Fig. 10) shows an early stage of hydronephrosis, corresponding in its development to that which I have often obtained before, a few days after ligating the ureter. Thus, while the size of the kidney still was less than before operation, a change which may be regarded as atrophy, it is not the example of true atrophy and cessation of function seen in Dog 5 and Dog 3.

Dog 8. Control. November 24, 1914. Same technic as in Dog 3, but veins were not ligated.

January 13, 1915 (50 days): Dog in good condition. Sacrificed with strychnine. Marked hydronephrosis on the right, the kidney being twice the size of its fellow. *Capsular vessels much engorged* (Fig. 11), but these vessels do not show up well in the photographs. A section of the organ (Fig. 12) shows the typical appearances of hydronephrosis. The kidney substance is thinned out to a mere shell and the pelvis is traversed by fibrous bands which carry the blood-vessels. The left kidney, although deeply injected, seemed otherwise normal.

It is obvious from these experiments (Dogs 3 and 7) and from my earlier work (Dog 5), that if the venous collaterals of the kidney do not develop, or if their formation can be prevented after occluding the ureter, hydronephrosis will not develop, and renal atrophy will take place.

These observations bear out the statements so often seen in the text-books, that sudden and complete occlusion of the ureter produces atrophy of the kidney, whereas partial or intermittent occlusion results in hydronephrosis. An investigation of the clinical aspects of this question which I made some years ago [5] showed that while sudden and complete obstruction of the ureter by ligature or clamp produced hydronephrosis in most cases, its development was rarely extensive. In fact, it was found that many surgeons had accidentally or intentionally tied off a ureter without disturbance to the patient either immediate or remote. It is obvious, therefore, that the results of the operating room differ from those of the laboratory. These experiments may also explain why it is that the hydronephrosis resulting from partial or intermittent obstruction of the ureter is of larger size than that seen when the obstruction is complete and sudden.

In the one case the intrarenal venous circulation is relieved of the embarrassment brought upon it by the encroachment of the slowly dilating uriniferous tubules, the extrarenal venous anastomoses have an opportunity to develop, and the secretion of urine is augmented, rather than decreased, owing to the change in the venous circulation. This accounts for the fact, so commonly seen, that the kidney whose ureter is but partially or intermittently obstructed may attain a sometimes enormous size, and also explains why it is that polyuria occurs in the kidney so affected. This polyuria is commonly observed both clinically and, in my experience, experimentally, the urinary secretion restoring itself gradually to a normal amount when the ureteral obstruction is removed and the venous circulation is no longer embarrassed.

If, on the other hand, the obstruction to the ureter is complete, sudden and permanent, tubule dilatation is pronounced, the intrarenal venous circulation is severely embarrassed, and before the extrarenal anastomoses are fully developed urinary secretion may almost, if not entirely, cease. While in most cases, as I have shown, these anastomoses develop rapidly and to a marked degree, resulting in hydronephrosis of considerable size, they may rarely fail to respond to the extra demands made upon them. In this event urinary secretion ceases almost entirely and atrophic and degenerative changes take place in the kidney.

The conclusions to be drawn from these observations are:

1. Sudden, complete and permanent obstruction of one ureter produces hydronephrosis in animals in the vast majority of cases, but

2. Atrophy of the kidney may develop in rare instances.

3. When hydronephrosis occurs the venous collaterals of the kidney are well developed; when atrophy of the kidney takes place it is due to a lack of development of these collaterals.

4. Atrophy of the kidney may be produced experimentally, by simultaneous ligation of the ureter and of the veins which maintain the collateral venous circulation of the kidney.

5. When the obstruction to the ureter is partial or intermittent the hydronephrosis is of greater size than when the obstruction is complete, sudden and permanent, for in the latter event, urinary secretion ceases before the venous collateral circulation has time to develop.

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# AN UNUSUAL CASE OF RENAL TUBERCULOSIS

By Benjamin A. Thomas, M.D.
and
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of Philadelphia
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In view of the fact that renal tuberculosis commonly masquerades under remote, unrecognized or misinterpreted urinary symptoms, and that it requires at times all the armamentaria at the command of the genito-urinary surgeon to arrive at a correct diagnosis, we have thought this case history of sufficient interest to report, owing to the fact that in spite of greatest thoroughness and precautions, the diagnosis was not correctly made until operation was undertaken. The possibility, by virtue of X-ray revelations, of confusing renal and ureteral tuberculosis with calculus of the kidney or ureter is well known to urologists and röntgenologists, but the error of mistaking a calcified plaque in the internal iliac artery for a ureteral calculus, which subsequently proved at operation to be a reno-ureteral tuberculosis without calcification, is, in the experience of the writers, a novel if not an excusable diagnostic blunder.

Charles R., white, aged sixty-two, referred by Doctor James E. Talley, was admitted to the Polyclinic Hospital, December 2, 1916, with the following history.

*Chief Complaint.*—Attacks of frequency and burning on urination, associated with pain in back.

*History of Present Illness.*—Symptoms date from 1912, but patient had backache as long as he can recall. He has been cystoscoped by his physician five times. Pain has been localized chiefly to left of costovertebral angle; never radiated to genitalia; often, however, transversely to midline. Urination and burning has been more frequent since cystoscopies were performed. At present he urinates every one and one-half hours.

*Family History.*—Negative.

*Previous Medical History.*—His only serious illness was typhoid fever in 1901.

*Physical Examination.*—Well-developed adult male; robust and plethoric in appearance. Lungs show no evidence of impairment. Heart is normal. Abdomen appears normal to inspec-

tion, palpation and percussion, including lumbar regions. Nervous system is negative. No abnormality by rectal palpation; genitalia likewise normal. Pulse is regular, somewhat hypertonic, but of normal rate. Blood-pressure: Systolic, 170; diastolic, 96.

The skiagraphic plates presented by the patient and taken at another hospital showed a shadow the size of a pea in the region of lower left ureter.

A urinalysis report, dated January 25, 1912, showed the urine to be acid; specific gravity, 1020; trace of albumen; very many leucocytes; no casts; no sugar; urea, 1.770. Another report, dated February 8, 1916, was as follows: Acid; specific gravity, 1017; pus; urate crystals; urea, 1.870. Our urinalysis, at time of admission, showed an acid urine with a specific gravity of 1015; a cloud of albumen; no sugar; a few red blood-cells and pus. Hæmoglobin 78 per cent.

After admission to the hospital the following functional kidney tests were performed.

*Indigocarmin.*—Intramuscular injection of 20 c.c. of a 0.4 per cent. solution appeared per catheter in twenty-four minutes, and quantitatively as follows:

| | |
|---|---|
| First hour | 5.31 per cent. |
| Second hour | 9.43 per cent. |
| Third hour | 6.25 per cent. |
| Total | 20.99 per cent. |

*Blood: Non-coagulable protein,* 58 mgm. per 100 c.c.; *urea nitrogen,* 22 mgm. per 100 c.c.; *creatinin,* 3.2 mgm. per 100 c.c.

*Cryoscopy: Blood* $a = 0.50$; *urine* $\Delta = 1.05$.

*Urine: Urea nitrogen,* 140 mgm. per 100 c.c.; *Urea Doremus,* 14.5 mgm. per 1 c.c.

December 9, 1916: *Phenolsulphonephthalein:* Intramuscular injection of 1 c.c. appeared per catheter in nineteen minutes, and quantitatively as follows:

| | |
|---|---|
| First hour | 7.50 per cent. |
| Second hour | 12.50 per cent. |
| Third hour | 17.50 per cent. |
| Total | 37.50 per cent. |

January 9, 1917: Patient was advised to have other skiagraphic plates made with a skiagraphic catheter in the left ureter. Cystoscopy at this time revealed the bladder to be the seat of low-grade inflammation, more marked in the region of the trigonum. Chromo-ureteroscopy employing indigocarmine (20 c.c.

of 0.4 per cent. solution) showed elimination of the dye from the right ureteral orifice within normal time limits, but no elimination from the left ureter for over twenty minutes. Indeed, no function at all was visible on the part of the left ureter. An attempt to insert a skiagraphic catheter in the left ureter was frustrated by a definite obstruction 2½ centimetres above the orifice.

Subsequent skiagraphic plates confirmed the pea-sized shadow observed in the original X-ray plates (Fig. 1). No shadows in the line of the ureter or the kidney above were visible.

The patient was advised to undergo operation for removal of calculus in lower portion of left ureter, and on January 25, 1917, the operation was undertaken.

A left inguinal incision was made. The peritoneum was reflected toward the midline, but did not lift the ureter, as is normally the case, inasmuch as it was found to be fixed by adhesions to the pelvic and lumbar tissues. The vas deferens was identified and traced downward. A small hard mass was encountered in the region of the internal iliac artery, and on exposure and palpation revealed a calcified plaque just below the bifurcation of the common iliac artery. The ureter, because of its size and the surrounding inflammation, was not surely identified until it was traced down from the kidney. The ureter was found to be greatly thickened and obviously tuberculous; no calculus was palpable. The inguinal incision was extended upward, and the kidney, not palpably diseased, save for dense adhesions about upper half, was, on inspection, observed to be mildly lobulated. Adhesions were separated from the diaphragm and peritoneum with great difficulty, tearing the latter for a distance of four inches; the rent was immediately sutured. The ureter was severed by cautery low in the pelvis between two ligatures. The vascular pedicle was then ligated and the kidney and ureter removed *in toto*. The wound was closed about drainage tubes inserted in the upper and lower angles.

Patient made uneventful recovery; was discharged and returned home on twenty-first day with a small sinus, which healed a week later.

*Examination of Pathological Specimen.*—Kidney on mesial section from pole to pole showed caseous cavernous renal tuberculosis. Many tubercles were seen in the vascular zone between the cortex and medulla of the organ. In a few cases the foci showed caseation and caverns filled with pus. Some of the cavities extended into the renal pelvis with resultant ulcerations and pus in that structure. The entire ureter was involved in the tuberculous process, was greatly thickened and markedly strictured.

The suprarenal gland, imbedded in and firmly adherent to a mass of

FIG. 1.—Skiagram showing shadow of plaque in internal iliac artery. Certain features of this shadow if more carefully observed might have helped us in avoiding our error, viz.: the ragged upper extremity and its axis extending downward instead of inward in direction of the bladder.

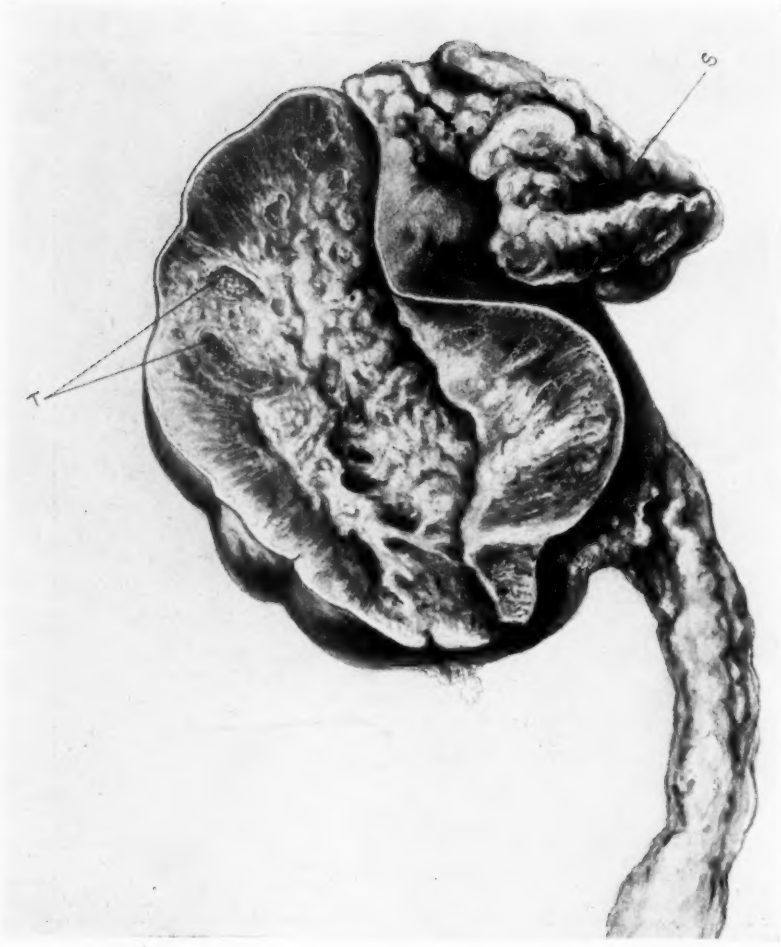


FIG. 2.—*T*, tuberculous cavities in kidney parenchyma; *S*, abscess cavity in suprarenal gland.

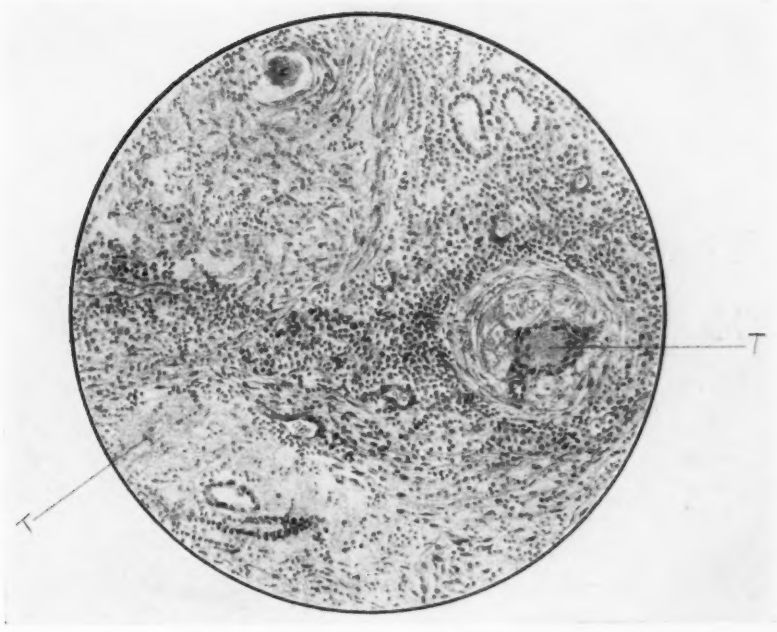


FIG. 3.—*T*, tubercles in kidney parenchyma. (Drawing from microscopical slide.)

perirenal fat, was enlarged to several times its normal size. Section of the gland revealed an abscess savity containing several drachms of caseous and purulent material (Fig. 2).

The microscopical drawing (Fig. 3) shows a number of typical tubercles located in the parenchyma of the kidney.

The post-operative review of this case presents the following points of interest: (1) A strictured or almost completely closed tuberculous ureter which by virtue of the correlation of the X-ray shadow and the level at which the catheter was obstructed permitted of the diagnosis of ureteral calculus; (2) an abscess of the suprarenal gland associated with the renal tuberculosis, but with no manifestation of Addison's disease.

# BILATERAL RENAL CALCULI

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The first renal calculus was removed from the living subject as recently as 1880, by Henry Morris, England. The first successful skiagraph of a renal calculus was made by McIntyre, Glasgow, 1896. Until radiographic technic had made considerable progress, diagnosis of renal calculus was uncertain, and many a surgeon expecting to remove a stone from a kidney was disappointed to find tuberculosis, tumor, cysts, or essential hæmaturia. We have at our command as aids to diagnosis, in addition to clinical symptoms, the cystoscope, renal function, and the X-ray; the greatest of these is the X-ray.

If every patient presenting typical symptoms of renal calculus were operated upon, there would be a very high percentage of disappointments, as we know that less than 50 per cent. of patients sent to the radiographer with a suspected renal calculus are reported back, positive.

Calculi vary in size from a grain of sand to several pounds, and in number from 1 to 40,000 (Sutton).

Bacterial infection of the kidney or its pelvis is a potent factor in the development of these calcareous deposits.

Bilateral renal calculi are found in 15 to 20 per cent. of all cases. Kummel in 101 consecutive cases of renal calculi found both kidneys involved in 16 instances. Bevan states the frequency is one in five, or 20 per cent. Joseph in making postmortems on infants from three and a half to eighteen months of age, found 40 with renal calculi and 23 bilateral, which is more than 57 per cent. It is known that many infants have calcareous deposits which disappear before they are many months old, thus probably accounting for the high percentage in infants.

A most interesting and unusual case of the appearance and disappearance of calcareous deposits in both kidneys and one ureter is reported by Newboldt (*British Jour. of Surg.*, vol. i, p. 334).

Man, twenty-eight, fractured right femur and tibia, non-union. After having been on his back for eight months, complained of pain in both loins and urinary bladder. Radiograph showed definite shadows in both kidneys and left ureter. Albumen, blood, and pus cells in urine. An acute attack of severe pain precipitated a few weeks later by riding several miles in a motor car. He was given nitromuriatic acid, aerated water, sour milk, and four lemons a day. During the

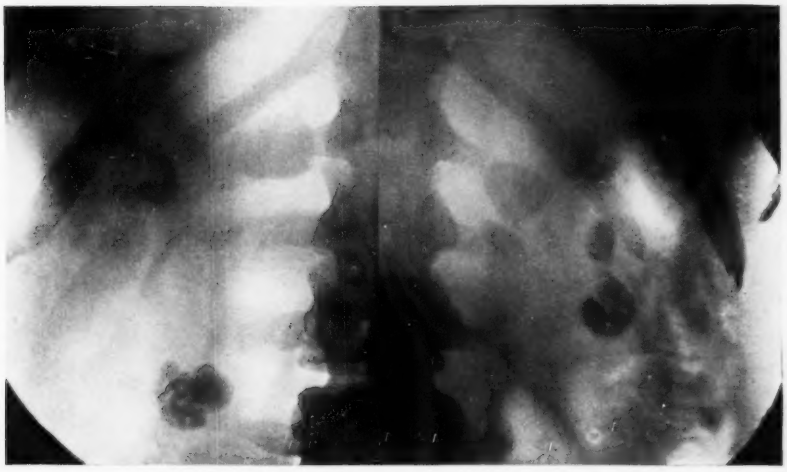

FIG. 1.—Bilateral renal calculi, composite. Skiagraph showing both lumbar regions.

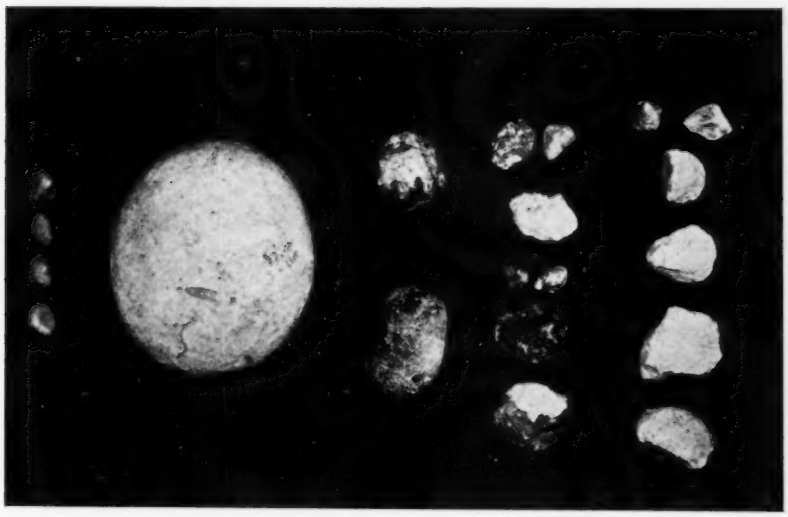

FIG. 3.—Four small ureteral stones to left were passed into bladder and per urethram. Fifteen months later the large round stone was removed from the urinary bladder. Six years later the remainder of calculi in this group were removed from both kidneys.

next few weeks he passed calcareous deposits with the urine. Two months later patient was entirely comfortable, urine normal, had regained his weight and radiographs negative. No recurrence months later.

That bilateral renal calculi may be present for a long period of time, cause the patient but little discomfort, and so completely destroy the kidney parenchyma that the patient dies from renal inefficiency, is evidenced occasionally in the post-mortem room. Less frequently now than formerly, thanks to the general geographical distribution of radiologists and urologists.

The following report of a case of multiple and repeated urinary calculi with development of bilateral renal calculi illustrates a number of interesting features pertaining to this subject.

W. R., adult, male, small stature, never weighing more than 120 pounds, amateur light weight pugilist and champion roller skater. His family history has no bearing upon his condition, except a younger brother at two years of age had a vesical calculus that became lodged in the urethra and was removed with some difficulty. The brother is now twenty-four years of age and has had no recurrence of urinary calculi.

He had the ordinary diseases of childhood. When six years of age was hit over the left kidney with a snowball. Immediately felt severe pain in region of left kidney. Pains would come and go, lasting from five minutes to several hours. No history of hæmaturia at that time. Says he had " kidney trouble " as early as eight years of age, but could give no definite account of the nature of the trouble. At age of twelve, passed a calculus size of a small bean, *per urethram*. When nineteen years of age had a mild urethritis which cleared up in three weeks without complications.

In May, 1909, when nineteen years of age, he came to me complaining of symptoms that suggested left-side renal or ureteral calculus. Radiographs were made which showed four separate and distinct shadows of calculi in the left ureter near the pelvic brim. Rest of the urinary tract negative. About one week later the patient was prepared for surgical removal of these calculi. A few hours before the time of operation, another radiograph was made and, much to the delight of all concerned, these four stones had gone from the left ureter into the bladder. This emphasizes the importance of radiographs of ureteral calculi just before operating. These four small stones were passed *per urethram* within a few days (Fig. 3).

Fifteen months later a stone as large as a small egg was removed, suprapubically, from the urinary bladder. This illustrates

that a calculus of considerable size can develop in a comparatively short time (Fig. 3).

During the next four years the patient experienced four attacks of renal colic with symptoms referred to the left side twice and twice to the right side. These attacks were made tolerable by hypodermic administrations of morphine, and each terminated with the passage of one to three calculi.

I did not treat him from 1909, when the large vesical calculus was removed, until October 12, 1915, when in consultation I found him reduced to a mere shadow, suffering great pain, thoroughly septic, urine loaded with pus, and large palpable mass in left renal region, which was diagnosed as pyonephrosis. The accompanying radiographs, by Dr. Sidney Lange (Fig. 1), revealed several calcareous deposits in both kidneys with consider-

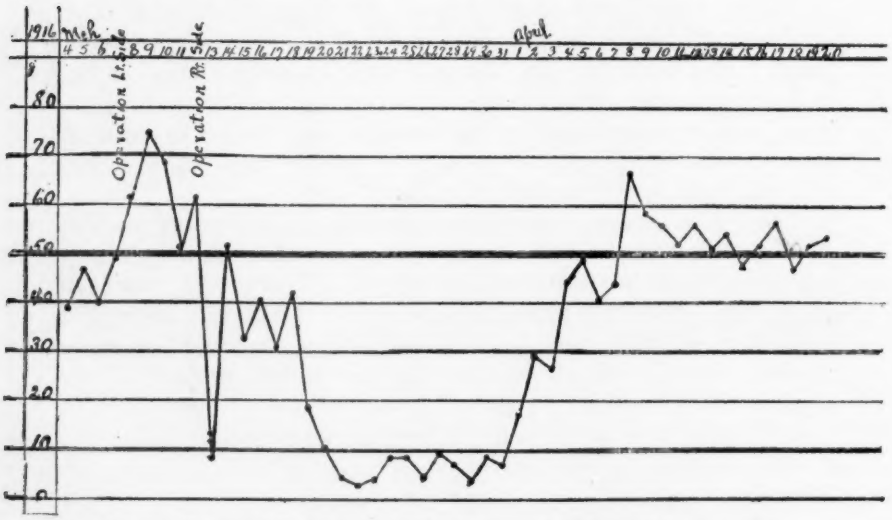


FIG. 2.—Showing daily urinary secretion in ounces by column of figures on left.

able renal enlargement. Every urological radiographic examination should include both kidneys, ureters, and bladder. On account of the very poor condition of the patient the left side was incised under local anæsthesia, a pyonephrotic sac opened and about 400 c.c. of thick, yellow pus removed with two calculi. The condition of the patient did not warrant further treatment at this time. A large-sized drainage tube was introduced after irrigating the sac, and the wound closed. Improvement was prompt and rapid. Tube removed at end of one week, patient left the hospital one week later and continued to improve until he had regained his lost weight and felt as strong as ever within two months. Urine, of course, remained cloudy. For three months he went

along very nicely, happy in the thought that he was well, as he was not told that the right kidney also had several stones in it.

March 4, 1916, he entered the Cincinnati General Hospital suffering great pain in left renal region, where a mass was again palpable. His general condition was so much better than at the previous operation in October that he was given a general anæsthetic, the left lumbar region incised and about 350 c.c. of pus removed from the old pyonephrotic sac. Careful exploration could now be made and all stones removed. No normal kidney tissue found. Flushing and drainage as before. Practically no shock or post-operative disturbances.

Five days later the right kidney was exposed. A large mass was brought up which proved to be an hydronephrosis. There was about one-half the normal amount of renal tissue present. The larger calculi were removed through a kidney incision and many smaller ones were flushed out. Drainage tube inserted into pelvis, kidney incision closed around the tube. Lumbar incision was closed. There was considerable surgical shock following this operation. The chart (Fig. 2) is a graphic illustration of the urine output. It is worthy of note that there was no diminution of urine secretion following the operation on the left side where there was no renal tissue, also that there was only eight ounces in the twenty-four hours following the operation on the right, the only kidney present, and that this renal parenchyma although traumatized, incised, and irritated with a foreign body, the drainage tube, secreted 52 ounces during the second twenty-four hours. This small amount of kidney tissue, about one-half of one kidney, continued to put out a normal quantity of urine. The apparent drop in daily output, as shown by the chart, was caused by the urine practically all coming through the wound into the dressings; as the wound healed the urine again came the natural way and in normal quantities.

The patient regained his strength rapidly and was soon busily engaged in the management of a restaurant, apparently as well as he ever was.

About ten months after the last operation he had two attacks of right renal colic, each lasting about thirty-six hours, during which time there was complete anuria. The attacks terminated suddenly with the expulsion of a mucous plug and the passage of large quantities of urine.

These experiences verified the statement that there was no active kidney tissue on the left side; while the right ureter was obstructed with a mucous plug there was no urine.

SUMMARY.—This patient received an injury over the left kidney which may or may not have had some bearing on the later developments. At age of twelve passed a urinary calculus and soon became a veritable stone quarry, until one kidney was totally destroyed and the other one-half destroyed. Contrary to Watson's suggestion, the worse side was operated first in this case, as there was the location of the pus which was causing the symptoms of sepsis. There was no diminution of kidney activity until the only kidney tissue was damaged surgically, and that came back within twenty-four hours. This case is a clinical demonstration of what Martin Fischer has shown experimentally with the rabbit, and that is that less than one-half of the entire kidney tissue can continue a normal urine output.

# EXPERIENCE WITH PAPAVERIN IN THE TREATMENT OF URETERAL CALCULUS

By Harry Atwood Fowler, M.D.
of Washington, D. C.

I have recently employed papaverin in three cases in the treatment of calculus of the ureter. The results have been so successful and prompt that I am led to believe that the expulsion of the calculus following the use of this drug is more than a mere coincidence. The more so as ureteral catheterization and the injection of sterile oil into the ureter, previously employed in the first case, had no apparent effect in changing the position of the stone.

My attention was first called to the use of the papaverin in cases of stone in the ureter by the report of Macht and Geraghty (*Johns Hopkins Hospt. Bulletin,* 1916, xxvii, p. 119). Before I had occasion to try out the preparation a further report on its use in three cases was made by Walther (*The Urologic and Cutaneous Review,* September, 1916). I have seen no further reports on its use in the literature, though doubtless it has been used by others.

A brief summary of my three cases follows:

Case I.—Maj. C. M. S., seventy-two years of age, was seen in consultation with Dr. Prosperi, with a diagnosis of stone in the left ureter. For several weeks he had suffered with severe attacks of general abdominal pain. Each attack was accompanied by gastro-intestinal symptoms: nausea, vomiting, flatulence, and loss of appetite. During this period of his illness another physician had suspected some intra-abdominal lesion. An X-ray examination of the gastro-intestinal tract was made and nothing abnormal was found. It was particularly noted that the pain was relieved by enemata and the passage of a great amount of flatus. A general surgeon saw the patient at this time, but was unable to find any definite signs of a lesion of the abdominal viscera. The condition was therefore thought to be due to indigestion. Dr. Prosperi saw the patient in a violent attack of pain, sudden in onset, referred to the left kidney region and radiating to the left groin. The obvious diagnosis of renal calculus was made and an X-ray examination of the urinary tract ordered. This examination showed a shadow in the course of the lower left ureter. This shadow in the first plate was overlying the edge of the sacrum and could have been easily overlooked. At the time the patient came under observation the urine was macroscopically clear as water.

Microscopically, it contained a few red cells and crystals of uric acid.

*Cystoscopy.*—The bladder was normal and there were no changes about either of the ureteral orifices. A No. 5 ureteral catheter was passed a distance of 5 cm., at which point an obstruction was met. With considerable manipulation this was passed and the catheter advanced to the pelvis of the kidney. A No. 6 catheter was afterwards passed. There was some bleeding alongside the catheter during this manipulation. Following this catheterization there was rather severe renal colic lasting several hours. An X-ray examination made four days later showed no change in the position of the stone. After an interval of fifteen days the left ureter was catheterized again and 5 c.c. of a 2 per cent. solution of papaverin hydrochloride was instilled through the catheter. There was no colic following this manipulation. Six days later, cystoscopy showed a stone presenting at the ureteral opening, but not projecting sufficiently to be grasped with forceps. A catheter was again introduced, pushing the stone slightly back into the ureter and papaverin sulphate, 5 c.c., was again instilled. This was seen to escape along the side of the catheter, but no dilatation of the orifice was observed. Following the second injection there was no pain immediately afterward or later. And the gastro-intestinal symptoms cleared up completely. Subsequent X-ray examination showed that the shadow in the ureter was absent and now appeared low down in the bladder area. Cystoscopy four days later confirmed the findings of the X-ray and revealed the stone about the size and shape of a peanut (meat) lying on the floor of the bladder. This was too large to pass over a slightly enlarged prostate. It was easily removed with a Young's rongeur.

CASE II.—J. A. E., a lawyer, forty years of age, in September, 1916, was seized with a sudden, severe pain in the left kidney region radiating down along the course of the ureter. Pain was controlled by a hot water bottle. Next day he vomited after eating. One month later he had a similar attack. At this time he had a thorough examination of the intestinal and urinary tracts. Physical examination revealed nothing, but the radiographs showed a shadow low down in the pelvic ureter. Fresh red cells were found in the urine at this time. When the patient came under observation, November, 1916, he was feeling fine but wanted matters cleared up. Physical examination was negative. The urine was clear, 1005, acid, and negative for albumen. An occasional red blood-cell was seen in the centrifuged specimen. In the absence of pain or kidney infection he was advised to await developments. In January, 1917, he was seized with another attack of pain similar in character and location. A feeling

of soreness persisted in the left kidney area. Red cells and leucocytes were present in the urine. A few days later cystoscopy showed a normal right ureteral opening. The left ureteral papilla was swollen, œdematous and puffy. There was a definite area of hyperæmia surrounding the left ostium, the lips of which were œdematous and pouting. The contrast between the two sides was most striking and suggested a lesion low down in the left ureter. A wax-tipped catheter was passed, meeting an obstruction 2.5 cm. above the bladder opening. Beautiful scratch marks were obtained. A large catheter was then passed, and 5 c.c. of papaverin hydrochloride instilled. The catheter was left in place for a minute or two after instilling the drug to prevent it from escaping. It is to be noted that no pain whatever was felt after ureteral catheterization and injection. During the next ten days there was no recurrence of pain, but he felt a slight burning on urination and at times a sudden stoppage of the stream during urination. Cystoscopy at this time showed a small fragment of stone projecting from the ureteral opening and imbedded in the œdematous mucosa. This was dislodged by a ureter catheter and recovered in the bladder washings. Papaverin sulphate was again instilled into the ureter and the patient told to carefully strain the urine. The following day he produced the stone, a rough uric acid calculus the size of a small pea. A subsequent X-ray plate shows the urinary tract free from shadows.

Case III.—A young man, aged thirty-three years, was first seen in October, 1916, complaining of a deep, severe pain in the left kidney area coming on a few days before. He has never had a similar attack. This one lasted nearly all day and passed off very suddenly. Since the attack he had had continual soreness and discomfort in the kidney region. Abdominal palpation was negative. The urine was clear, but a centrifuged specimen showed a few red cells and leucocytes. X-ray examination showed a shadow in the left kidney pelvis. The apparent size of the stone suggested the possibility that it might enter the ureter and pass spontaneously. As the patient could be kept under observation, it was decided to wait for a time, although we had grave doubts of his passing it. Following several sharp attacks another X-ray examination was made in February, 1917, which showed the stone shadow low down in the pelvic ureter. At this time dull pain and soreness in the back was more or less constant and demanded relief. Cystoscopy showed a normal right ureteral orifice. The left papilla was greatly swollen, œdematous, standing out prominently with an unusually broad surface. In the centre the ureteral orifice appeared as a round hole. This orifice would open with each ureteral contraction and then contract, but never completely close. A No. 6 catheter was passed 3 cm., and

met an obstruction, which finally was passed and the catheter advanced to 20 cm. Withdrawing the catheter to a point just above the obstruction, 3 c.c. of papaverin hydrochloride was instilled. There was no pain following this manipulation. A few days later the stone was expelled per urethram.

*Comment.*—A striking feature observed in all these cases was the absence of renal colic following the use of papaverin. Ureteral catheterization is not infrequently followed by rather sharp pain along the course of the ureter and in the kidney area lasting sometimes for a few hours. This often amounts to little more than a feeling of discomfort and soreness. In none of these cases was there any pain whatever following the catheterization and instillation. This was unquestionably due to the analgesic properties of papaverin and its effect locally in overcoming spasms of the ureter. The expulsion of the stones in these cases following the use of papaverin was not attended with the usual attack of colic. After injection all symptoms subsided and did not recur, and the patients were not aware that the stone had left the ureter until it was discovered in the bladder (Case I) or was passed per urethram (Cases II and III).

This suggests further the possible value of papaverin used as an injection after any ureteral catheterization to overcome the spasm of the ureter and the associated pain which is observed in certain cases. It appears to be non-toxic in the dosage employed, hence there would seem to be no objection to its use on that score. The pharmacology of papaverin with reference to its action upon the smooth muscle of the ureter has been studied by Macht (*Journal of Pharmacology and Experimental Therapeutics,* vol. ix, No. 3).

While no conclusions can be drawn from the use of this drug in three cases only, the results here reported appear to justify its further use in similar cases. The results in the first case were so striking and prompt after catheterization and the injection of oil had failed to dislodge the calculus, that no time was lost in the next two cases in employing papaverin without first trying the simple catheterization and oil injections. While these latter measures might have been quite as effective I believe the absence of all pain following the use of papaverin is a desideratum worth considering. I may add that the alkaloid papaverin was obtained at the pharmacy. From this the pharmacist prepared both the sulphate and the hydrochloride and made up a 2 per cent. solution of each. No difference was noted in the action of these two solutions. As the sulphate is much more soluble, and hence its solutions more easily prepared, this is recommended for use.

# RECENT OBSERVATIONS IN CYSTOSCOPIC TECHNIC

By William F. Braasch, M.D.
of Rochester, Minn.

With the multiplication of various aids to the diagnosis of disease of the urinary tract there has been an increasing tendency to employ one and all of the methods without considering their individual necessity. As a result many unfortunate complications have arisen which could have been obviated if greater care and better judgment had been exercised. The following rule should be adhered to as a guiding principle by every urologist: namely, make no manipulation in the urinary tract other than is necessary in order to complete a diagnosis.

We have grown to regard simple cystoscopy such a commonplace diagnostic procedure that we are apt to employ it when the clinical data are sufficient without it. There should be well-founded indications for cystoscopic examination. In the presence of a negative urinalysis and negative physical examination a cystoscopic examination should not be made merely because the patient complains of a slight degree of bladder irritability. Nor is an occasional pus-cell in the urine a sufficient reason for cystoscopic examination in the absence of other indications, since an occasional pus-cell or red blood-cell is frequently found in a passed specimen of urine when there is no lesion in the upper urinary tract. It is unnecessary to state that the finding of pus-cells in the urine of a female patient is of no value unless the urine is obtained by catheter. Cystoscopy should not be resorted to in order to identify every obscure abdominal pain unless the pain is associated with renal or vesical radiation. Neither is it necessary to resort to cystoscopy to identify every indefinite shadow in the röntgenogram unless supported by clinical indications. There is usually definite contra-indication to any cystoscopic procedure: (1) when the patient is aged and infirm, (2) when the patient is in an emaciated and weakened condition, (3) when there is bilateral renal involvement of extreme degree, and (4) when it is apparent that no surgical procedure would be of benefit.

Routine cystoscopic examination in every case of prostatic hypertrophy is unnecessary and may be followed by grave complications. I have known death to result on several occasions following cystoscopic examination in the presence of a very large prostate. In prostatic hypertrophy cystoscopy should be attempted only (1) when on rectal examination the prostate is so small that it is questionable whether it

could be the cause of urinary obstruction, (2) when the patient's symptoms are suggestive of a foreign body, tumor, diverticulum, or unilateral renal complication, and (3) when the Röntgen ray shows shadows of a questionable nature. When the Röntgen shadow is definitely the shadow of a large stone there is no need of cystoscopy to corroborate it.

When a cystoscopic examination is indicated in the presence of a large gland it is well to use a cystoscope of small caliber. Such an instrument should be used more frequently in routine cystoscopy of conditions other than hypertrophy. Many urethras are too small to permit of the passage of standard-sized cystoscopes without injury. A cystoscope of large caliber will frequently cause considerable bleeding and laceration of the urethra and its use is often followed by severe forms of urethritis and prostatitis. I have observed several cases in which a stricture of the urethra followed cystoscopic injury. Although a cystoscope of small caliber usually permits only single ureteral catheterization, nevertheless a fairly complete examination can be made. When, on attempting cystoscopy, intolerable pain is caused, it is unwise to endeavor to complete the examination at one time. If the bladder is catheterized and irrigated daily over a period of ten days or two weeks, it is surprising how much more tolerant the patient becomes to instrumentation.

Severe reaction is occasionally seen following simple catheterization of the ureters. I have observed several patients who have been in bed as long as several weeks with chills and fever following simple catheterization of a kidney previously normal. Only recently, in a case in which a ureteral catheter was introduced into the pelvis of a supposedly well kidney (the other one being destroyed) and allowed to remain in the ureter for fifteen minutes while a differential functional test was made, there was subsequent acute exacerbation of a mild chronic pyelonephritis, uræmia and death. Although it is true that in a vast majority of cases there is no danger in renal catheterization, I have repeatedly observed instances in which an infection occurred in the previously healthy kidney following catheterization when infection was present in the other kidney. When it is apparent that the patient's symptoms are caused by lesions in the bladder or urethra it is not always necessary to catheterize both kidneys. When it is apparent that there is a unilateral surgical kidney it is often unnecessary to catheterize the other kidney. However, should there be any doubt as to the functional value of the other kidney and catheterization is necessary to ascertain this, the procedure is justified. Occasionally catheterization

of the normal kidney can be obviated by the simple procedure of catheterizing the diseased kidney and making a differential functional test. The bladder specimen will then represent the functional activity of the non-catheterized kidney.

Considerable trauma and unnecessary pain may be caused by the use of a ureteral catheter of too large caliber. There is usually much less reaction following the use of a catheter of a caliber which permits it to be introduced without meeting much obstruction. The forcing of a large catheter such as a No. 7, or even a No. 6, through a small meatus and up a small ureter with great pressure may be followed by considerable injury. When it is desired only to obtain a specimen from the kidney, a No. 5 catheter will suffice in the majority of instances. It is seldom necessary to use a catheter of larger caliber than No. 6 except in cases of ureteral dilatation.

Pilcher[1] emphatically states that he considers pyelography a very dangerous procedure in the hands of any except the most expert, and that the method should be used only when a definite diagnosis cannot be made by any other means. In my opinion this is a timely warning and should be taken to heart by every one attempting to make a diagnosis of conditions in the urinary tract.

When the value of pyelography as an aid to diagnosis finally became recognized, it was employed generally. It was not long, however, before many cases were reported in which renal complications and even death followed its use. As a result of these dangers the method for diagnosis was in a fair way to be entirely discarded. An attempt was then made to discover some medium which would not cause injury to the kidney. Of the mediums proposed, thorium-nitrate solution had many evident advantages over the others, and it was hoped that a medium for injection had been discovered which would meet all the ideal requirements.

Having used thorium extensively since its introduction almost two years ago, I regret to state that while it has many practical advantages over the other mediums, it may be fully as harmful as colloidal-silver suspensions. When it has been retained in the pelvis of the kidney in hydronephrosis it has occasionally been the cause of diffuse abscesses throughout the cortex similar to those seen with the use of colloidal-silver suspension. The only difference in the resulting lesion is that on microscopic examination no evidences of particles of undissolved silver are visible. The kidney tissue throughout appears markedly irritated and inflamed and the pelvic mucosa shows evidence of

[1] Pilcher, P. M.: Practical Cystoscopy, Philadelphia: Saunders, 1911, p. 157.

acute pyelitis. The microscopic evidence of infection and necrosis is to all appearance the result of irritation and infection ascending from the renal pelvis by way of the tubules. In a series of cases in which we endeavored to remove the injected thorium solution from the pelvis following pyelography, no necrosis resulted. It is advisable, therefore, following the injection of thorium when hydronephrosis is suspected to leave the ureteral catheter in place so as to allow the fluid to drain away. This should be followed by repeated lavage with sterile water until every trace of the medium is removed. Unfortunately, this is not always possible because of retention in the ends of the dilated calyces. Dilatation of the renal pelvis may usually be recognized by other cystoscopic means than pyelography. Recognizing the possible danger resulting from retention of injected mediums, we should endeavor to make the diagnosis of hydronephrosis without resorting to pyelography, and its use should be confined to cases in which other methods of diagnosis leave us in doubt.

Since interference with the drainage of medium injected for pyelography is the cause of resulting damage we have similar problems to meet in the diagnosis of radiographic shadows appearing in the ureteral area. In attempting to identify these shadows, I have on several occasions seen similar evidence of renal infection and cortical abscesses following ureteral pyelography, which could be relieved only by removal of the obstructing stone, and in one case required nephrectomy as well. It is obvious that it is fully as necessary to remove the injected medium completely in cases of stone obstruction as in cases of hydronephrosis.

In the majority of cases in which shadow interpretation is necessary, the evidence obtained by the cystoscope, the ureteral catheter, and the wax tip will suffice. When an impassable obstruction is met with, a shadowgraph catheter will usually be sufficient. However, when there is a suspicious shadow in the original röntgenogram and the catheter meets with little or no obstruction, pyelo-ureterography may be employed to great advantage and is frequently the only method by which an exact diagnosis can be made. Such conditions will permit of thorough drainage and evacuation of the injected medium.

Because of possible retention of the injected medium, it is obvious that simultaneous bilateral pyelography is never justifiable. Furthermore, before a pyelogram is made, we should be reasonably certain that the other kidney is normal. Unilateral pyelography with bilateral lesions, such as nephrolithiasis, polycystic kidney and fused or horseshoe kidney, is attended with greater danger than when the lesions are unilateral and should be attempted only when the indica-

tions are urgent. When a horseshoe kidney is suspected, the relative position of the kidney and pelvis can usually be ascertained by means of a shadowgraph catheter. If further complicating pathology is suspected, pyelography can be resorted to later if necessary. Although it has been said, and with truth, that when complications follow pyelography the kidney is usually otherwise surgical, occasionally a moderately diseased kidney suffers such injury following pyelography that nephrectomy is necessary.

Cystopyelography is also not without its dangers, although it is true that none of the bladder medium will gravitate to the kidney unless there is free access through a dilated ureter. In two instances in which the medium had entered the kidney by gravity from the bladder, it was subsequently impossible to drain from the dilated calyces present. As a result, the patients suffered severe reaction, and, after a prolonged convalescence, their renal function was considerably impaired.

The diagnosis of hydronephrosis may be arrived at usually by other means than pyelography: (1) By the determination of residual urine in the pelvis, (2) by over-distention, and (3) by withdrawal of retained fluid through a syringe. When the ureteral catheter has been introduced into the dilated pelvis the retained urine will run out in a continuous stream without peristaltic hesitation. This can usually be quickened and slowed at will by manual pressure over the kidney area. Continuous rapid flow from a ureteral catheter without peristalsis may occur, however, when there is nervous hypersecretion in kidneys otherwise normal. Such hypersecretion is always bilateral and therefore can be differentiated from the unilateral rapid excretion from a dilated renal pelvis.

The well-known over-distention method of Kelly has proved invaluable in the diagnosis of hydronephrosis. Although there has been some dispute as to the capacity of the normal pelvis, it is now generally recognized that when any amount greater than 15 c.c. can be injected without causing pain dilatation is suggested. This does not, however, necessarily signify that the pelvis itself has a capacity of 15 c.c. The injection of 15 or even 20 c.c. of fluid before pain results is possible with an actual pelvic capacity much less, since part of the injected fluid may return along the side of the catheter to variable distances down the ureter. Therefore, the amount injected in such a case represents the capacity of the pelvis and a part of the ureter as well. This may be proved by injecting an opaque fluid; the partial return flow will be evident in the pyelo-ureterogram.

My experience with the last-named test, the withdrawal of residual urine, has brought out several points of interest. It is evident that if there are several ounces of retained fluid in a dilated pelvis it may usually be withdrawn through the ureteral catheter by means of a syringe. On several occasions, however, I have noticed an interesting phenomenon, *i.e.*, that similar suction will withdraw several ounces of fluid from a kidney with a pelvis of normal size. This occurs, however, only when there is a condition of excessive hypersecretion. It is necessary that the ureteral catheter should fill the ureteral lumen so that suction with the syringe establishes a lower intra-ureteral pressure. It would appear that the process is one of glomerular filtration and is dependent on the difference in intrarenal pressure. A large amount of fluid withdrawn from a hypersecreting kidney can be differentiated from residual urine by the fact that when a hydronephrosis is present the amount withdrawn can be injected back into the kidney pelvis without causing pain, whereas in normal hypersecreting kidneys if an ounce of urine is withdrawn, renal colic will usually be caused by re-injecting 5 or 10 c.c.

In conclusion, I would say that pyelography should not be used when the diagnosis can be made without it. Even though the diagnosis remains in doubt, pyelography should not be attempted if the patient is old and feeble, or weak and emaciated, or if the condition of the other kidney is not normal. When clinical conditions are favorable, however, and a pyelogram is made, it is advisable to leave the catheter in the ureter for at least fifteen minutes so that it may drain thoroughly. The pelvis of the kidney should then be irrigated repeatedly with sterile water. The patient should be kept under close observation and if there is evidence of marked pelvic retention the kidney should again be catheterized within twenty-four hours, the ureteral catheter allowed to drain for several hours, and the pelvis again irrigated. If the patient does not recover following this procedure, a nephrectomy should be done without further delay. By a careful selection of cases and the use of all the technical precautions, the percentage of injury will be reduced to a minimum. Pyelography is of too great value to be discarded, for a number of conditions cannot be diagnosed without it. However, it is obvious that the method should not be employed by one who has not had considerable cystoscopic experience and who has not the facilities to observe the patient carefully during and after examination.

# THE VALUE OF BACILLUS BULGARICUS IN TREATMENT OF COCCUS INFECTIONS OF THE BLADDER

By Richard Frothingham O'Neil, M.D.
of Boston

Since Dr. Caulk drew the attention of the Association at the 1914 meeting to the brilliant results obtained in the treatment of incrusted cystitis with an emulsion of the Bulgaricus bacillus, we have been considerably interested in following out this treatment in all suitable cases. We think the report of results obtained and our conclusions drawn therefrom may not be without interest.

I shall not take the time to go into the pathogenesis, descriptions of the lesions or symptomatology of the disease, which are all well known and have been fully described; but will give the histories of a few cases, more or less in detail, which we believe well illustrate certain points of importance.

In all cultures of our cases of incrusted cystitis the culture showed a growth of streptococci and staphylococci, *Bacillus proteus* and *Bacillus coli.* Beyond this no attempt was made to plate out any given strain of bacteria. The cultures in our cases after treatment showed, with two exceptions, colon bacilli only.

*Preparation Used.*—In the earlier cases emulsions made from tablets were used. These were not very satisfactory and the tablets examined almost invariably showed a contamination, mostly with cocci and a few various kinds of bacilli. This was proved by cultures on milk and then worked out on other media, a large Gram-positive staphylococcus being most common.

We then used the liquid culture put up in 10 c.c. tubes, which on examination showed pure culture of *Bulgaricus bacilli.* I understand there is now a new tablet on the market said to be reliable, but we have had no experience with it nor have we had any experience with the *Bacillus acidophilis.*

The technic is simply to inject 20 c.c. into the bladder through a catheter after preliminary cleansing irrigations. If the patient is on constant drainage the catheter is plugged or clamped off for a couple of hours. If there is an open suprapubic wound. some attempt is made to hold the edges together for a time at least. The treatment should be given daily to obtain good results, and be accompanied by the administration of acid sodium phosphate. There were no reactions from the injections in any case.

The cases roughly fall into two groups: First, those showing more or less incrustations on the bladder wall alone, and, second, those which show in addition a marked tendency to the formation of phosphatic calculi, recurring rapidly after removal—most of our cases of this type having undergone multiple operations for the removal of calculi.

The following are illustrations of the first group:

CASE I.—Genito-urinary Department, Massachusetts General Hospital. A. E., aged forty-one; single; insurance agent. First seen in Out-Patient Department, June 26, 1915, with the following history: Presenting symptoms, frequent and painful micturition; duration, seven years. Has passed white chalk-like material from bladder and of late the urine has contained blood. At present, micturition day and night at intervals of one-half hour to an hour; intervals never longer than an hour. Three years ago pain in right kidney region, none at present. A previous X-ray said to have been negative for stone. Bladder very irritable. Urine contained blood and clots. Put on oleum santali; urine taken for examination for tubercle bacilli; an X-ray taken showed a curious mottled appearance in region of bladder from which a diagnosis of incrusted bladder was made.

July 7: Has passed 15 phosphatic fragments since last visit. Some obstruction and grating in deep urethra.

July 10: Urine cloudy but not bloody; alkaline. Smear showed a Gram-positive coccus. 20 c.c. emulsion of *Bulgaricus bacilli* put in bladder.

July 13: Urine acid. Patient still passing calculi.

July 29: Came in with fragment stuck in posterior urethra, which was pushed back into bladder. Has been having almost daily treatment with bladder injections of 20 c.c. of emulsion of *Bulgaricus bacilli.* The urine is acid. A urethral stricture has been dilated to No. 26 French, and the bladder holds 4 ounces. A radiograph taken a week ago shows considerable diminution in amount of calcification in bladder region.

August 9: X-ray shows some phleboliths but nothing in bladder region.

August 16: Bladder is not now irritable.

Cystoscopy: Mucous membranes generally roughened but paler than usual. No vessels seen. No calculi seen. but in some places what seem to be adherent mucopus. Right ureter in normal position. Left not made out.

September 2: Urine strongly acid. Patient has received treatment at irregular intervals.

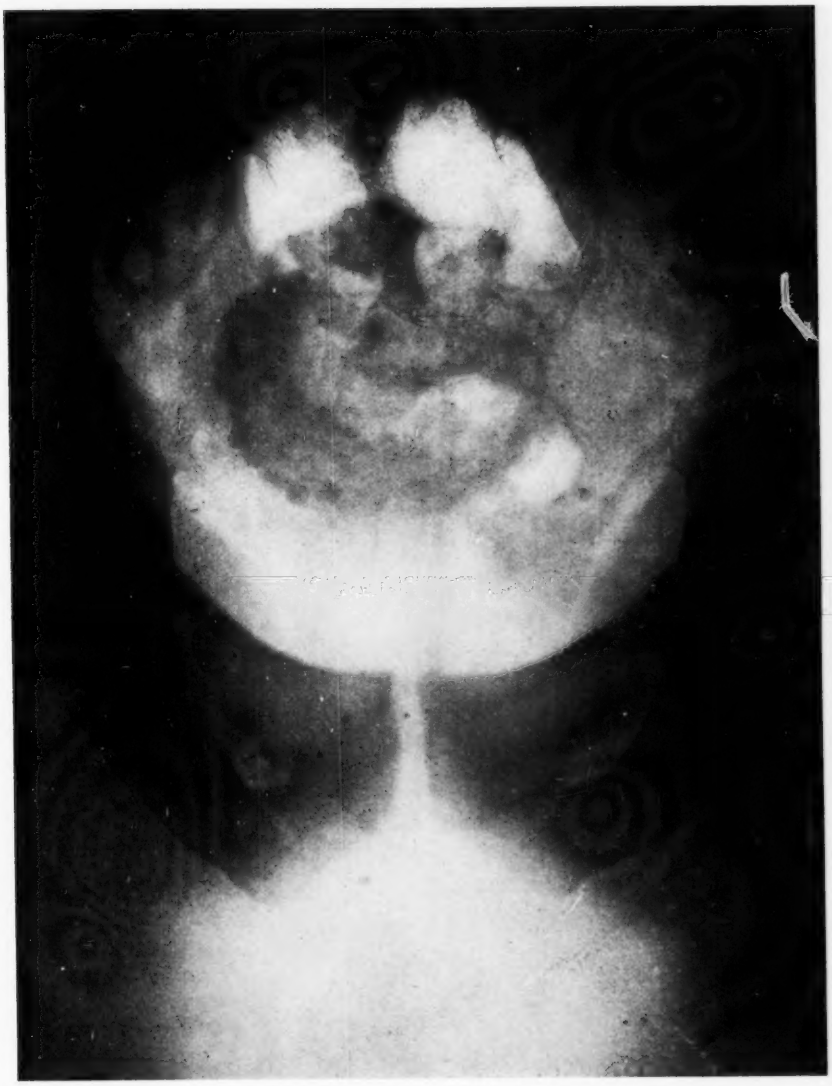

FIG. 1.—Radiograph before treatment. Note the well-marked shadow of the incrusted bladder also the mottled appearance, which is typical.

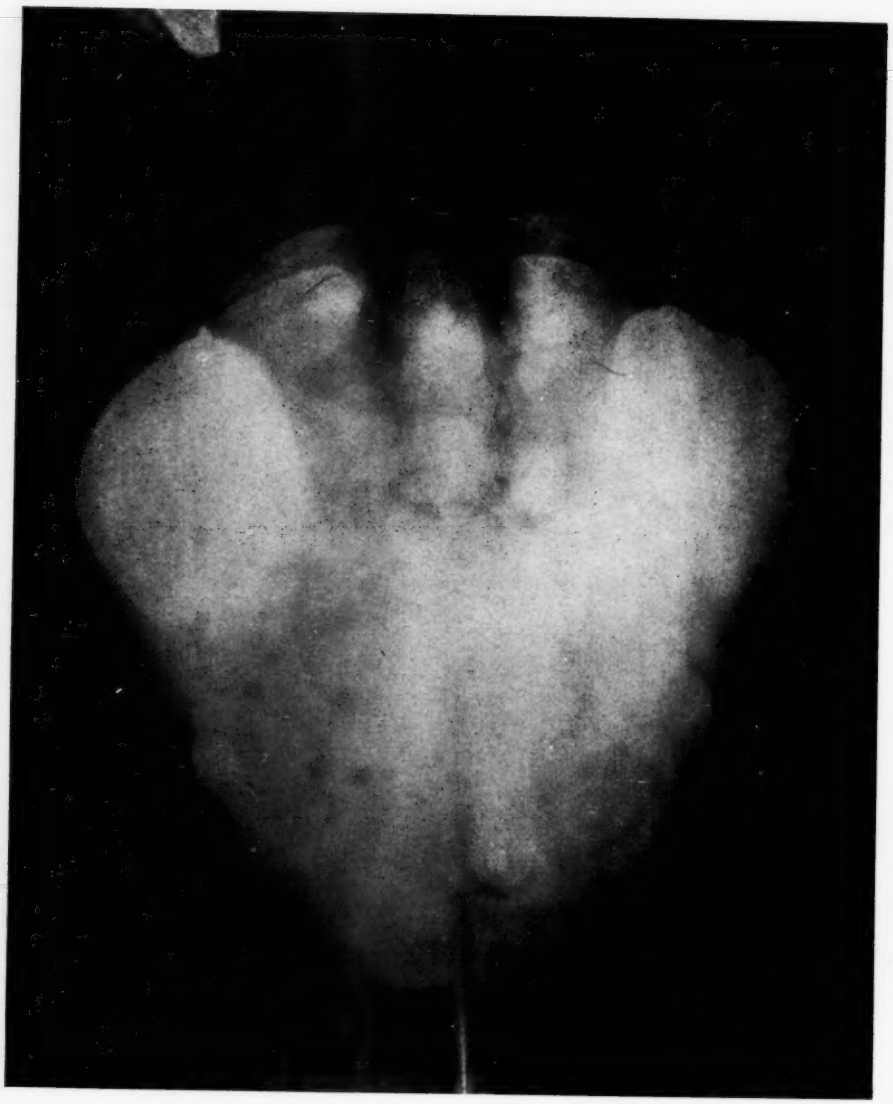

FIG. 2.—Shadows still visible, but mottling much less extensive.

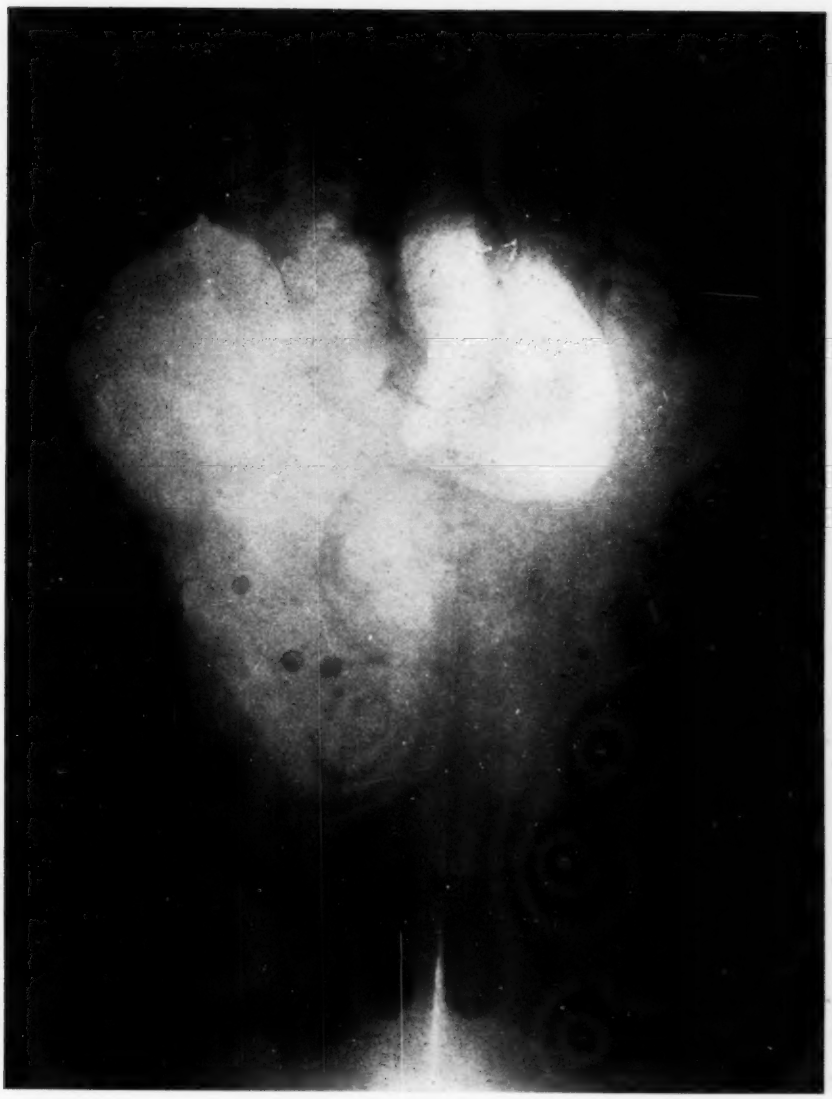

FIG. 3.—Mottled appearance has disappeared. Only a few phleboliths to be seen, which are visible in the other plates.

October—: When last seen, practically no treatment for a month. Condition poor; is having chills frequently. Patient has been lost sight of, but at the last visit was evidently failing rapidly from what we supposed to be a bilateral renal tuberculosis. A guinea-pig inoculation from patient's bladder urine was positive. The ureters were never catheterized.

Although highly unsatisfactory from a clinical standpoint, this case is of interest as showing the power of the *Bulgaricus bacillus* to combat the alkalinity of the urine and incrustation formation even in the presence of the underlying infection, which in this case was tuberculosis. This is well demonstrated by the successive X-rays, the cystoscopic examinations and the improvement in the urine while the treatment was being regularly carried out.

CASE II.—C. L. E., aged twenty-nine; married; colored; housewife. Genito-urinary Department, Out-Patient Department, Massachusetts General Hospital. Five years' frequency of micturition and pain in left flank.

April 13: Cystoscopy showed an incrusted cystitis with alkaline urine. Culture showed streptococci. Treatment started with *Bulgaricus bacilli.*

April 25: Cystoscopy. Urine alkaline. Areas of incrustation much less than at previous examination. Both ureters catheterized. Urine from right, acid, with a little blood, no bacteria, albumin s. p. t. (blood?). Urine from left faintly acid, epithelial cells, no tubercle bacilli, streptococci, albumin trace.

May 2: Improving. Treatment continued. This case is still under observation and is of interest because the ureters were catheterized and the reaction from the kidney shown to be acid and faintly acid against the bladder urine being strongly alkaline. There is as yet little improvement in the urinary symptoms, but the incrustations have practically disappeared.

The following cases are illustrative of the type associated with the rapid formation of calculi:

CASE III.—Mrs. G., aged thirty-three. Private case of Dr. H. Cabot. February 16, 1916: Two and one-half years ago, following childbirth, bladder infection. One and one-half years ago, stone in the bladder crushed. One year ago suprapubic cystostomy showed an incrusted bladder. Passing small stones very frequently; always in pain.

*Examination.*—Healthy looking woman. Catheter specimen of urine strongly ammoniacal; cloudy, alkaline, 1024, albumin good trace, sugar 0. Sediment shows pus, many varieties of bacilli, some Gram-negative streptococci and staphylococci, some

other bacilli, probably *Proteus vulgaris*. *Bulgaricus bacilli* put into bladder. ℞ Acid sodium phosphate.

From February 18 to March 29, eight treatments at varying intervals. Urine remained alkaline.

March 29: Entered hospital. Urine has been acid since three days after entrance. Cystoscopy shows fewer incrustations around neck of bladder than at previous examination. With operating cystoscope these were picked off, a few small particles washed out, the rest left to be passed.

April 15: Cystoscopy under ether shows a small incrustation near the vesical neck on the upper right hand side, and a small one on the lower left side. Bladder otherwise normal. These incrustations were on the base of a considerable slough, but were removed with the curette.

April 22: Cystoscopy shows a slough remaining on the left side of vesical neck, but without incrustation except at five o'clock, where there is a very small incrustation.

April 25: Bladder washed out; small particles in wash water apparently corresponding to what was seen at last observation. Urine strongly acid. Instillation of *Bulgaricus bacilli* continued.

This case shows the necessity of constant regular treatment, as no results were obtained until patient was placed in a hospital. She will be kept under observation and it seems reasonable to suppose that she can be kept free of calculi.

Case IV.—J., male, aged sixty-seven. March 24, 1915, entered Genito-urinary Service of the Massachusetts General Hospital. Urinary symptoms for a long time. Had passed gravel. Incontinence for two years. Bladder very irritable. Urine foul; alkaline. Culture shows staphylococci and streptococci. Cystoscopy, spinal anæsthesia, shows a considerably incrusted bladder and a small, white calculus at base. Litholapaxy.

March 31: Daily treatment with *Bulgaricus bacilli* 20 c.c.. liquid culture. Cystoscopy: Bladder irritable but mucosa not reddened. No evidence of incrustation remaining. One or two flakes of adherent mucopus. Urine remained acid while in hospital.

*Summary.*—This is a case of bladder infection of unknown origin associated with alkaline urine and a coccus infection, resulting in calculus formation. Complete cure in a week by litholapaxy and acidulation of the urine by *Bulgaricus bacilli*.

Case V.—J. Mc., aged seventy-six, female. ———— 29, 1915, entered Genito-urinary Service of the Massachusetts General Hospital. Frequent painful and difficult micturition for eleven years. For last five years in constant pain and has passed gravel; on one occasion acute retention from fragment.

April 15: X-ray shows a shadow in region of bladder, probably stone. Cystoscopy: Bladder mucous membrane red and dirty, with incrustations and a calculus size of sparrow's egg.

April 30: Litholapaxy, spinal anæsthesia. Fragments washed out; put on drainage. Daily treatment with 20 c.c. liquid emulsion of *Bulgaricus bacilli*. Urine acid in twenty-four hours.

August 24: Four months after operation. One month after operation began to have frequency and pain. Two months after operation began to pass small stones and pus. Has had no treatment with *Bulgaricus bacilli* since leaving hospital.

March 9, 1916: Has vesical incrustations and has passed a good deal of calcium detritus. Cystoscopy: No calculus but area of incrustation and a few small phosphatic granules.

March 10: Emulsion of *Bulgaricus bacilli* injected. Urine acid. Feels much more comfortable.

*Summary.*—This case relapsed immediately on the cessation of treatment, and showed immediate improvement on its being resumed.

CASE VI.—S. L., male, aged sixty-eight. July 9, 1913, Genito-urinary Service, Massachusetts General Hospital. Suprapubic prostatectomy.

October 2, 1914: Cystoscopy shows considerable prostatic tissue remaining, two white calculi and a very considerable incrustation of bladder wall. Urine alkaline. Culture shows colon bacilli and large numbers of streptococci and staphylococci.

October 13, 1914: Litholapaxy. Urine alkaline.

October 20: 20 c.c. *Bulgaricus bacilli* injected after residual had been withdrawn. Urine strongly acid next day.

October 26: Daily treatment with *Bulgaricus bacilli*. Cystoscopy shows a small amount of phosphatic detritus adherent about trigone. No evidence of large deposits seen at the time litholapaxy was done. Ureters, which had previously been hidden by incrustations, easily seen. Culture shows *Bulgaricus bacilli* and *colon bacilli*.

October 30: Feels well. No residual. No irritation. Urine hazy acid, many colon bacilli.

November 7: Urine acid. Culture shows colon bacilli and a large coccus.

December 14: Has continued about same. Reporting regularly for treatment; when he omits it the urine becomes alkaline but quickly becomes acid on resuming injections.

April 22, 1916: Two months ago passed a small stone. Urine cloudy and alkaline. Residual 12 ounces. Cystoscopy shows a deep median cleft; considerable prostatic tissue remaining; a small white calculus behind left ureter.

April 29: Litholapaxy; local anæsthesia. This case still has residual urine from incomplete prostatectomy. While under observation was in good condition. Urine could be kept acid. All treatment given up and he returned with alkaline urine and calculi.

CASE VII.—S. W., male, aged sixty-three. Genito-urinary Service, Massachusetts General Hospital. July 14, 1915: Bladder trouble for ten years; frequency, with occasional stopping of stream. In 1911 had a "tumor above the prostate gland" removed. Urinary symptoms were not relieved by this operation. Passed several small stones. In 1914 four large stones were removed. In June, 1915, a stone in the bladder was crushed; four days later passed a small stone. Cystoscopy: Bladder much inflamed. Considerable remaining prostatic tissue. A light phosphatic calculus in base of bladder.

July 15, 1915: Litholapaxy. Urine has been alkaline. Treatment with emulsion of *Bulgaricus bacilli.* Urine became strongly acid after forty-eight hours, and remained so during stay in hospital.

In October, 1915, his physician reports that the patient is free from calculus. The urine is acid and is kept so by using *Bulgaricus bacilli* once in three weeks.

March 2, 1916: Cystoscopy, spinal anæsthesia. A very much reddened bladder with a diverticulum in the roof; no stone present. Ureteral catheter passed into diverticulum shows it to be about one inch deep and containing no detritus. Placed on constant drainage.

March 14: Has been quieting down steadily, although urine still shows pus. Has been using bladder irrigations and injections of *Bulgaricus bacilli* ever since last operation for stone.

April, 1916: Readmitted to Massachusetts General Hospital for treatment of urinary symptoms; apparently pericystitis.

*Summary.*—This is a case of prostatic obstruction with a marked tendency to the rapid formation of phosphatic calculi. By constant use of emulsion of *Bulgaricus bacilli* the urine has been kept acid and there has been no calculus formation for over ten months.

In addition to the cases showing definite incrustation and calculi, we have been in the habit of employing the emulsion of *Bulgaricus bacilli* as a routine in all cases where the bladder has been opened and an alkaline urine persists after operation. We have also employed it in the treatment of sloughing and incrusted urinary wounds.

## CONCLUSIONS

From the analysis of these and other cases, we feel justified in drawing the following conclusions:

1. That the incrustations met with in this form of coccus infection, with an alkaline urine, can be more rapidly and permanently removed by the acidulation of the urine by the bacteria than by any other means.

2. That in certain cases where the incrustations are associated with alkaline urine and a marked tendency to the formation of soft phosphatic calculi, their recurrence may, to a considerable extent, be prevented by maintaining a strongly acid urine by this means.

3. That the method may be of value in the treatment and prevention of the incrustations sometimes seen in urinary wounds.

4. That the treatment to be of value must be carried out at regular intervals and will show better results in private practice or when patients are confined in the hospital than when treated in Out-Patient Departments.

5. That the method is of little permanent value where the infection is not confined to the bladder.

6. That the treatment is entirely without any untoward effects.

# SARCOMA OF THE BLADDER IN A CHILD

By Charles G. Mixter, M.D.

of Boston, Mass.

Assistant Surgeon to the Children's Hospital

Bladder tumors occurring in children are of such rare occurrence that it seems proper to put individual cases on record. The rarity of such growths in relation to other tumors of the bladder is readily shown by large groups of cases.

In 252 cases reported by Albarran, only six occurred in the first decade of life. In the series of 114 cases reported by Judd in 1912 from the Mayo Clinic, there was but one case under ten years of age. This was not a primary vesical tumor, as it was an angioma involving both the rectum and bladder. Gardner in 1915 collected 369 cases of tumor of the bladder from various surgeons for a report on the results of operative procedures in this condition. Only two occurred in children. Of 62 cases from the Massachusetts General Hospital, investigated by O'Neil in 1915 for an article on "Bladder Tumors in the Young," not one occurred in a patient under ten years of age. Of approximately eight hundred cases of bladder tumor included in these various groups, only eight, or one per cent., of the vesical tumors occurred in children.

Forty-one cases in children were collected by Concetti in 1900 from the literature. Steffens in 1905 collected 32 instances, many of the same cases being included in both groups. These series show that nearly 75 per cent. of the bladder tumors in children occur before the fifth year. Munwes in 98 collected cases of sarcoma of the bladder found 15 per cent. in children under ten. As so great a preponderance of the sarcomatous tumors of children were manifest in the very young, he suggested the embryonic origin of these tumors. This view coincides with our conception of the genito-urinary tumors of children. Of the seventeen new-growths of this tract that we have seen on the surgical service at the Children's Hospital in the last eight years, nearly all may be classified as embryomata. They are of the connective-tissue group and have been designated as different types of sarcomata, depending on that particular type of tissue which has preponderated in the sections examined. It seems probable that they may be derived as fetal "rests" from the Wolffian body. The pathological aspects of the new-growth in the case reported below correspond with this type of tumor.

## SARCOMA OF THE BLADDER IN A CHILD

Tumors of the bladder in children are clinically malignant, as they have a marked tendency to recur. Pathologically as well, they are malignant, as they may invade the deep layers. They do not tend to metastasize. They are usually situated near the neck of the bladder, arising from the mucous or submucous coats of the trigone, or near the ureter orifice. They may be single or multiple, pedunculated or sessile.

The symptoms are those of vesical irritation: Frequency, tenesmus, pain, incontinence or retention. Cystitis develops, and occasionally bits of tumor tissue will be passed in the urine. Unlike the vesical tumors of adults, hæmaturia is rare, as these growths do not tend to ulcerate.

The diagnosis is often difficult. Persistent vesical irritation in the absence of stone or a congenital stricture of the urethra should raise the suspicion of a bladder tumor. Occasionally, an irregularity of the bladder wall may be detected by a searcher. Repeated urinary examinations may reveal tumor elements. Cases are reported in female children, where portions of a pedunculated tumor have prolapsed through the urethra and have appeared at the external meatus. Cystoscopic examination in older boys and in even very young girls is of extreme importance in suspicious cases.

The course is almost invariably fatal. Occlusion of the vesical outlet may cause dilatation of the ureters and consequent pyelonephritis; or the ureteric orifices may become involved. The growth may infiltrate adjacent organs, as the prostate, abdominal wall, uterus or vagina, and death follow from exhaustion or cachexia.

To quote from O'Neil from whose article much of the data in the foregoing remarks has been derived, "Vesical tumors in children are a very great rarity. The great majority appear before the fifth year. They are of the connective-tissue type and are clinically and pathologically malignant except in rare instances. Difficulties in micturition are generally the earliest symptom; in the absence of stricture they should excite suspicion. Straining is common. Early diagnosis and operation offer the only hope of recovery."

The report of the case of bladder tumor in a child that has come under my personal observation is as follows:

> L. S., female, three and one-half years old, admitted to the Surgical Service of the Children's Hospital, October 18, 1915.
>
> *Family History.*—Mother suffering with gastric ulcer for last seven years. Father living and well. Only child. No tuberculosis.

*Personal History.*—Full term. Normal delivery. No contagious diseases. Always well. Appetite good. Bowels regular.

*Present Illness.*—Six months ago child began "bed wetting." Urine seemed strongly ammoniacal. Three months ago urination became frequent, once every two hours. Began to lose weight and strength. Urination became painful two months ago. Shreds noticed in urine. One month ago large shred passed about two inches in length and three-eighths inch in diameter. Examined by the pathological department of the Harvard Medical School. "The tissue is poorly preserved. It appears, however, to be sarcomatous in nature. It is quite cellular, with a stroma." Urethra was sore for several days after shred was passed. Soon the child began to gain in weight and less difficulty was experienced in urination. Five days ago child became restless and nervous. During that night the attacks of painful urination came on again. Defecation painful. Last night attacks of pain and frequent micturition occurred every half hour. No blood has been seen.

*Physical Examination.*—Well developed and nourished child. General examination negative. Abdomen soft. No masses or tenderness. Genitalia: Vagina slightly inflamed. Urethral orifice is somewhat œdematous and urethral mucous membrane is everted. No discharge.

During observation in the hospital it was noted that the attacks of pain came on just before urination; were severe, lasted four to five minutes, and were followed by complete relief on voiding. In the intervals between urinations the child was absolutely free from pain. The von Pirquet reaction was negative. The white count was 27,000; polymorphonuclear leucocytes, 86 per cent.; large mononuclear leucocytes, 4 per cent.; lymphocytes, 10 per cent. The urine showed microscopic pus and blood. No tubercle bacilli were found.

October 23: Cystoscopy, ether anæsthesia examination revealed a large, lobulated, sessile tumor, arising from the right lateral wall of the bladder, in the region of the right ureter orifice. The orifice, however, could not be seen, as it was hidden by the mushroom type of growth. The surface of the tumor was smooth, not ulcerated, no bleeding areas seen; in some places necrotic. The tumor was thought to be the size of a hen's egg.

*Operation* (October 27).—Ether. Abdomen opened near median line and peritoneal cavity explored. No evidence of metastases found except a small smooth mass ⅞ inch in length by ½ inch in diameter, lying directly in the course of the urachus. Immediate examination of the specimen; diagnosis, "congenital

cyst of the urachus." The abdominal bladder wall was smooth. The peritoneum was closed and the bladder opened anteriorly. The tumor was slightly smaller than a hen's egg. The base was one and one-half inches in diameter. It arose to the outer side of the right ureter orifice which it overhung, but there was a gap of ½ inch of apparently healthy bladder wall between the base of the tumor and the orifice. Ureteral transplantation, which it had been feared might be necessary, was not done. Excision was not deemed advisable at this time, owing to the duration of the operation, and the bladder was closed with drainage.

The child made a good recovery and the suprapubic drainage gave relief from pain.

*Second Operation* (November 15).—Ether. Incision reopened. Peritoneum stripped back and a transverse incision made downward across the right lateral bladder wall to the tumor. Tumor excised by an incision including all the coats of the bladder and leaving a margin of ¼ inch of healthy tissue around the base of the growth. Posteriorly the tumor had grown upward in close contact with the ureter for about one inch, but seemed well encapsulated. After reconstruction the bladder appeared about 3 inches in length, 1½ inches in diameter and the lumen would barely admit the index finger.

The *pathological report* from Professor Wolbach of the Harvard Medical School: Frozen section diagnosis; fibrosarcoma. Tumor evidently of slow growth. The prognosis should be favorable, as the growth is sharply defined where attached to the bladder.

The complete pathological report: Gross specimen, roughly spherical tumor of the bladder, 4 cm. in diameter, attached by a base of 2 cm. in diameter to the inner surface of the bladder wall. Projecting externally from the bladder wall is a nodule 1 cm. in diameter, which is continuous with the main tumor mass. The free surface of the tumor is slightly flattened and nodular. Surrounding the base is a narrow zone of bladder wall. Consistency of the tumor is tough and elastic; œdematous in appearance. On palpation harder nodular portions are found. The free surface of the tumor and the nodules projecting from the external surface of the bladder are sharply delimited. The external nodules appear encapsulated. The limits of the tumor in the bladder wall itself are poorly defined.

*Microscopic Examination.*—The tumor as a whole is composed of loose-textured connective tissue. The cells are either large spindle-shaped or have several processes. The intercellular substance is loose, fibrillar material (collagen). Fibroglia fibres are prominent. Throughout the tumor are islands of more cellular arrangement. Occasionally several cells lie in lacunæ, suggesting differentiation into cartilage, but nowhere does the intercellular tissue resemble cartilage matrix. The growth is invading the muscularis of the bladder wall, and must be considered malignant, though mitotic figures are rare. It comes under the general class of embryomas.

Following operation there was a prolonged period of suprapubic drainage, the sinus finally closing at the end of six weeks. The capacity of the bladder was at first 1½ to 2 ounces. In the sixteen months since operation there has been a gradual dilatation, and at present 4½ ounces are voided at one time. Progress in this direction has been slow, and the child has been urged to void frequently to prevent soiling her clothes. With the coöperation of the parents, proper training of the bladder should produce a marked improvement in this respect. There have been three attacks of pyelitis of mild degree since operation. Cystoscopic examinations have been made at intervals of about every four months, the last examination having been made on February 20, 1917. At that time the child was in excellent general condition. Cystoscopy showed no evidence of recurrence of the tumor.

# THE USE OF RADIUM AND THE PUNCH OPERATION IN DESPERATE CASES OF ENLARGED PROSTATE

By Hugh Hampton Young, M.D.
of Baltimore, Md.
(From the James Buchanan Brady Urological Institute, Johns Hopkins Hospital)

In the treatment of cases of prostatic hypertrophy one is frequently confronted with severe complicating conditions which require most careful study and treatment before an operation to cure the obstruction to urination can be carried out. The kidneys are so frequently injured by long standing back pressure that the phthalein test shows in more than 40 per cent. of the cases an impairment requiring drainage for a more or less protracted period and forced water by mouth to restore them to a sufficiently good condition for operation. The heart is also frequently involved as a result of the renal lesions, but both kidneys and heart usually improve rapidly on appropriate preparatory treatment so that perineal prostatectomy can be carried out without danger.

The ordinary valvular lesions and moderately severe myocarditis are usually not sufficient to contra-indicate perineal prostatectomy, though care should be taken both in the preparatory care of the patient and in choice of anæsthetic—which should be ether in such cases. A quick operation and thorough packing of the wound to prevent loss of blood is sufficient to carry them through safely. It is often amazing to see how well they convalesce and in not a few instances the heart is benefited by the removal of a focus of infection in the prostate. Occasionally we meet with very severe cardiac conditions which do not clear up or improve sufficiently under careful hospital treatment to warrant the risk of a serious operation. Such cases usually go unoperated and unrelieved, and it is with the idea of furnishing a new means of curing such cases of urinary obstruction that I am presenting the following case:

The patient arrived at the hospital in desperate condition. An enlarged prostate with 1300 c.c. residual urine had led to great impairment of the kidneys, and severe degeneration of the heart which was in such bad condition that the patient came near death several times during the nine months of treatment which he underwent. It was evident early that a serious operation was out of the question. Anæsthesia

also would have been too dangerous, and various cardiac experts who saw him agreed that a major operation would kill him.

We therefore determined to attempt to cause atrophy of the prostate and shrinking of the intravesical lobes by simple means—radium and fulguration—and the history will show that this was remarkably successful. But as the obstruction to urination still persisted, it was finally decided to carry out a "punch operation" through the urethra to remove the obstructing collar which remained at the prostatic orifice. This was entirely successful—no further catheterization was required and normal urination has been restored—now of eight months' standing.

Along with this has come a wonderful betterment of his general health, but as the details are important both to surgeons, internists and pathologists, I will give the history of the case in full.

CASE HISTORY.—H. M. H. (No. 4413), aged fifty-three, single, admitted June 2, 1915, complaining of frequent and painful urination, and at times incontinence, fluttering of heart, weakness, nausea and vomiting.

*Family History.*—One sister had cancer.

*Past History.*—Scarlet fever, diphtheria and mumps as a child. Measles at the age of thirty years. Pneumonia four years ago. No history of tonsillitis, but for the past five years has had shortness of breath, palpitation and fluttering of the heart on going up stairs and on arising in the morning. No pain and no œdema, but considerable nausea often associated with vomiting. Suffers greatly from dyspepsia and often has severe gastric crises. No history of lues or urethritis.

*Present Illness.*—About five years ago began to have difficulty and frequency of urination. The obstruction has slowly grown worse, and during the past year the frequency of urination has increased greatly and of late there has been occasional incontinence. For four weeks he has suffered considerably with pain in the bladder, strangury, and, during the last two days, with hæmaturia. His general health has been greatly impaired. He has much dyspepsia, stomachic distress, nausea, vomiting, cardiac irregularity, palpitation and loss of weight. At present he voids urine from 2 to 7 times at night and very frequently in the day, often associated with urgency, burning and pain on urination, and hæmaturia. He has never been catheterized.

*Examination.*—The patient is tall, thin, pale and feeble. The chest is symmetrical; percussion note hyperresonant, and breath sounds high pitched and rather harsh. Vocal fremitus normal and no râles present. Heart much enlarged. P. M. I. is seen

11 cm. from M. S. L. in fifth I. S. R. C. D. extends 11.5 cm. to the left and 3.5 cm. to the right of the M. S. L. The sounds are rather clearly heard at apex, but extremely irregular, skipping a beat about every 9 or 10 beats. Many beats do not appear to reach the wrist. Over the base of the heart the sounds are pretty well heard and the A-2 seems to equal P-2 in intensity. Pulses are easily felt and appear synchronous, though many of the beats heard at the apex do not reach the wrist. The tension and volume appear rather low and artery wall is perhaps slightly thickened. Blood-pressure, 128–80.

Abdomen: Full, rather distended, with a high-pitched, tympanitic note throughout. Liver dulness extends from fifth rib to 2 f.b. above the costal margin. Spleen is not felt, liver edge not felt. Kidneys not palpable. No masses nor tenderness.

Genitalia: Negative.

Rectal: The prostate is moderately hypertrophied, rounded, smooth, slightly indurated. Both seminal vesicles are slightly indurated.

Catheter: Residual urine 1300 c.c.

Cystoscopy: Both lateral and median lobes are enlarged. The median lobe is quite prominent and obscures most of the trigone. The bladder is markedly trabeculated, and on the left side the orifices of cellules and diverticula are seen.

Urine: Amber, acid, specific gravity 1010, no sugar, albumin a trace.

Microscopically: Red and white blood-corpuscles and bacilli.

Leucocytosis: 13,600. Phthalein test: appearance time, fifteen minutes; first hour, 12 per cent.; second hour, 15 per cent.; total, 27 per cent. Blood urea: 0.576 gramme per litre.

*Clinical Impression.*—The patient is a weak sick man with bad heart and impaired kidneys, due to great back pressure from enlarged prostate. Much gastro-intestinal disturbance. Needs very careful preliminary treatment, continuous catheter drainage, water in large amounts and cardiac therapy. Operation now absolutely contra-indicated.

*Treatment.*—Rest in bed, continuous catheter drainage, forced water. Digitalis p.r.n.

June 7, 1915: Patient much exhausted, heart weak, greatly troubled with abdominal distention. Phthalein test yesterday showed a marked drop; appearance time forty minutes, first hour, 2 per cent., second hour, 12.5 per cent., total, 14.5 per cent. (drop of 12.5 per cent.).

June 12, 1915: Slightly improved. Now taking digipuratum b. d. until 12 doses are taken. Cardiac condition better.

June 15, 1915: Comment, " Phthalein test not improving, heart

bad, anæsthesia and prostatectomy would surely invite fatal ending. It is therefore decided to try radium, with the hope that atrophy of the prostate and relief of obstruction to urination will result."

June 16, 1915: *First radium treatment*: 1709 mg. screened by lead covered with 3 inches of gauze and rubber tissue, applied over the perineum. Treatment carried out by Dr. Burnam for eight hours.

June 17, 1915: Patient somewhat exhausted. Pulse a little better. Blood urea improved, now .348 gm. per litre (drop from .576). Phthalein 21 per cent. for two hours.

June 19, 1915: Fulguration applied to middle lobe through cystoscope.

June 26, 1915: Retention still complete. Second fulguration.

June 27, 1915: Phthalein test: appearance time, twenty-six minutes, first hour, 5 per cent., second hour, 10 per cent, total for two hours, 15 per cent. Blood urea, .35.

July 3, 1915: Cystoscopy: The median and posterolateral portions of the prostate are distinctly smaller and are covered with a grayish slough. The left posterolateral portion is more prominent and is fulgurated to-day for five minutes.

July 4, 1915: Retention still complete. Fourth fulguration (median lobe).

July 5, 1915: *Second radium treatment:* 1709 mg. screened as before, applied over lower end of sacrum five hours, over suprapubic region five hours.

July 13, 1915: Retention still complete. Fifth fulguration of prostate.

July 20, 1915: The patient has been wearing a retention catheter up to this time. Retention still complete. General condition, especially heart, greatly improved. Phthalein test shows steady improvement since primary drop after insertion of catheter; is now: appearance time, thirteen minutes, first hour, 14 per cent., second hour, 19 per cent., total, 33 per cent. Blood urea, 0.36.

Rectal examination: The prostate is distinctly smaller and less rounded.

July 22, 1915: *Intra-urethral applications of radium begun:* 103 mg. screened with a platinum capsule 2mm. thick (26-F. in diam.) inserted with a special instrument (Fig. 1), so that radium lay within the internal sphincter, and against the anterior surface of the median lobe. Duration of treatment forty-five minutes (held in place by adjustable clamp attached to table as shown in Fig. 2).

July 26, 1915: Patient up in chair two days and catheterizing himself. Œdema of legs and scrotum for first time.

August 7, 1915: *Résumé:* Patient still has complete retention. Is able to void small amounts, but only after considerable straining. He is using a catheter at four to six hour intervals, removing between 400 and 500 c.c. On rectal examination the prostate is small, flat, soft, and one would not judge from the rectal examination that there was present any hypertrophy whatsoever.

Cystoscopic examination shows the bladder mucous membrane slightly congested, the trabeculations are well marked, particularly posteriorly, and to-day one can see the inter-ureteral muscle which, up to this time, has not been visible. Examination of the vesical orifice shows it slightly irregular, somewhat œdematous. On the right side in the region of the right lateral lobe there is present a well-developed, rounded lobule which evidently projects across the urethra at that point. Posteriorly the edge is small, and there is present only a median bar. On the left side a definite projecting lobe, which was present at previous examination, has apparently almost disappeared and the margin shows nothing but the irregularities which are due to œdema of the mucous membrane.

August 9, 1915: The patient was examined to-day, and the lobe on the right side fulgurated vigorously. Patient is going home this evening, and is to return again in about a month. Phthalein test: appearance time, seventeen minutes, first hour, 14 per cent., second hour, 17 per cent., total two hours, 31 per cent.

October 8, 1915: *Second admission:* Patient has been at home for two months. He has been catheterizing himself 4 to 6 times daily. Retention still complete. Patient very weak and nervous, suffers with frequent nausea and stomachic distress. Cardiac condition has become much worse, now very bad, heart action extremely irregular, pulse 140, irregular in force and rhythm. Apex in sixth interspace 14.5 cm. to left. Area of relative cardiac dulness extends 2.5 cm. to right in fourth interspace, and 15.5 cm. to left in fifth interspace. Sounds at apex cooing in character, second accentuated. No definite murmurs. Chest emphysematous, sonorous râles. Blood-pressure 120–85. Red blood-cells, 4,568,000. Hæmoglobin, 80 per cent. Blood urea, 0.564. Phthalein: appearance time, fifteen minutes, first hour, 12 per cent., second hour, 12 per cent., total, 24 per cent. Urine: cloudy, acid, specific gravity, 1016, albumin a trace, leucocytes, epithelial cells and bacteria.

October 20, 1915: Patient has been very sick, extremely weak, with persistent nausea and vomiting. Heart very irregular and weak. Right radial pulse almost imperceptible to-day. Left radial very irregular in force and rhythm.

November 30, 1915: During the past month condition has been variable. For the last five days has received digipuratum grs. iii, twice daily. Heart action still quite irregular and rate at apex varies between 80 and 90. Blood-pressure 115/60. Stomach has improved greatly, is gaining in strength. Urinary condition unchanged, still wearing retainer catheter. Phthalein: 24 per cent. in two hours.

December 6, 1915: Pulse has varied between 68 and 80. Digipuratum grs. iii t.i.d. since November 30. To-day put on grs. iii b.d. General condition improved.

December 14, 1915: Heart much better. General condition fair. Pulse 70, beats forceful, all coming through to wrist now.

December 15, 1915: Retention still complete—inlying catheter. Cystoscope shows a small rounded middle (posterior) lobe, a small prominent anterior lobe, no enlargement of lateral lobes. Prostate per rectum flat, very little broader than normal.

December 16, 1915: Second intra-urethral radium treatment: 103 mg. applied for two and one-half hours in 3 positions in front of middle lobe as shown in chart (Fig. 3).

December 27, 1915: Third intra-urethral radium treatment: 103 mg. in thin brass capsule surrounded by rubber catheter (Fig. 4), one hour in deeper portion of prostatic urethra and one hour in anterior portion of prostatic urethra, as shown in chart.

January 17, 1916: Fourth intra-urethral radium treatment, with rubber catheter as before, one hour with radium within internal sphincter.

January 24, 1916: Fifth intra-urethral radium treatment, as before, one and three-quarter hours at vesical orifice, and one hour in anterior half of prostatic urethra.

February 21, 1916: *Résumé:* During the past eight months the patient has had two massive doses (1709 mg. each) of radium applied from the back and front; five intra-urethral treatments with 103 mg. at a position against the middle lobe or within the internal sphincter seven hours, and in the anterior half of the prostatic urethra two hours; five fulgurations to the middle and lateral lobes at the vesical orifice.[1]

As a result the prostate has decreased greatly, but complete retention of urine persists. The kidneys are markedly improved as a result of the catheter drainage, but the cardiac condition, though much improved, is still much too bad to consider any form of prostatectomy under an anæsthetic—the unanimous opinion of consultation of medical and surgical examiners.

[1] In later cases I have used intrarectal treatments of radium in addition to the intra-urethral, as shown in Figs. 12, 13, and 14.

FIG. 1.—Instrument for introduction of radium in platinum capsule into urethra or rectum.

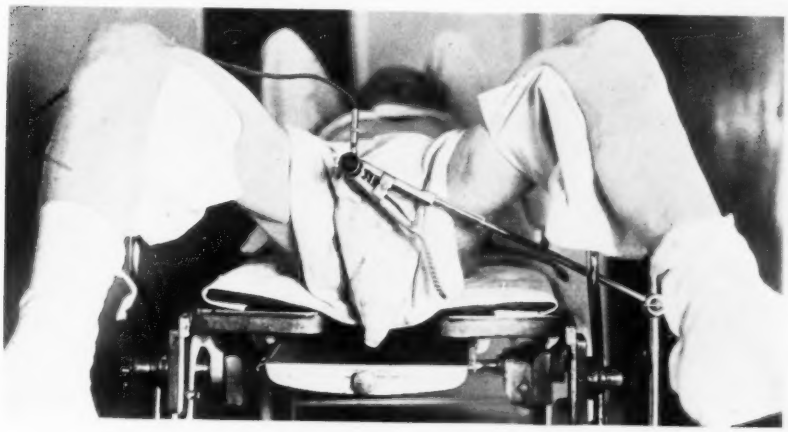

FIG. 2.—Showing retention clamp attached to table holding radium in desired position in urethra or bladder. (In this photograph the tubular radium instrument carrying the cystoscope was employed.)

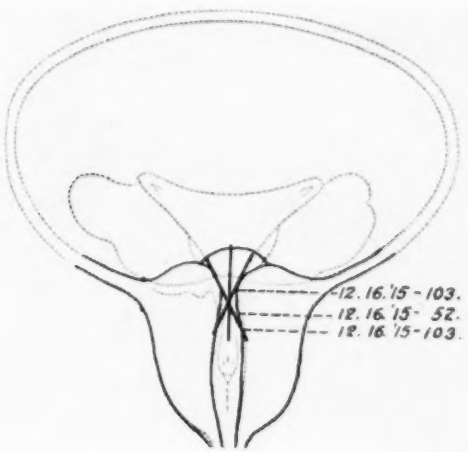


FIG. 3.—Chart showing second radium treatment given December 16, 1915, and milligramme hours in each place.

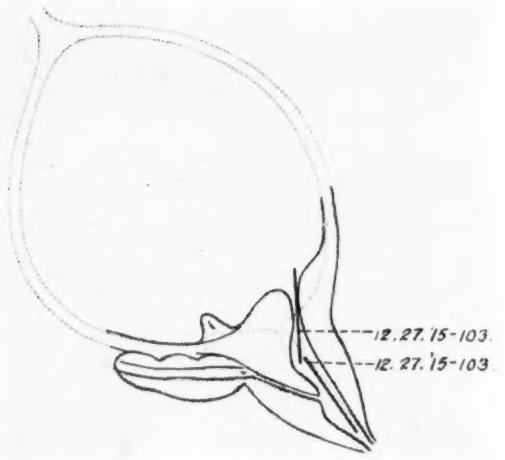


FIG. 4.—Chart showing third radium treatment on December 27, 1915.

FIG. 4a.—Showing sectional view of rubber catheter carrying radium in glass tube surrounded by metal tube with coude curve to inner end.

FIG. 5.—Showing obstructive bar remaining at neck of bladder after radium treatments.

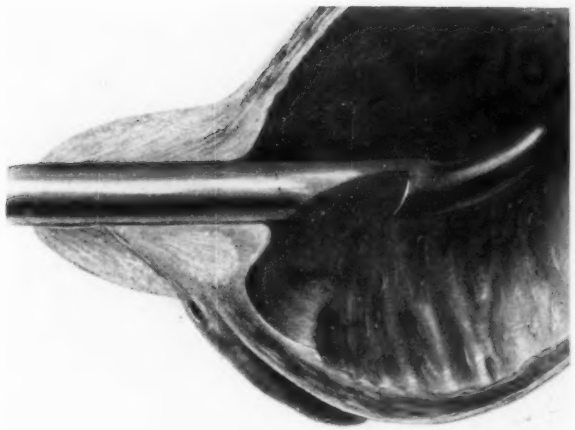

FIG. 6.—Median bar excisor or punch instrument introduced into bladder, cutting inner tube withdrawn allowing fluid to escape, showing that the instrument is in the bladder.

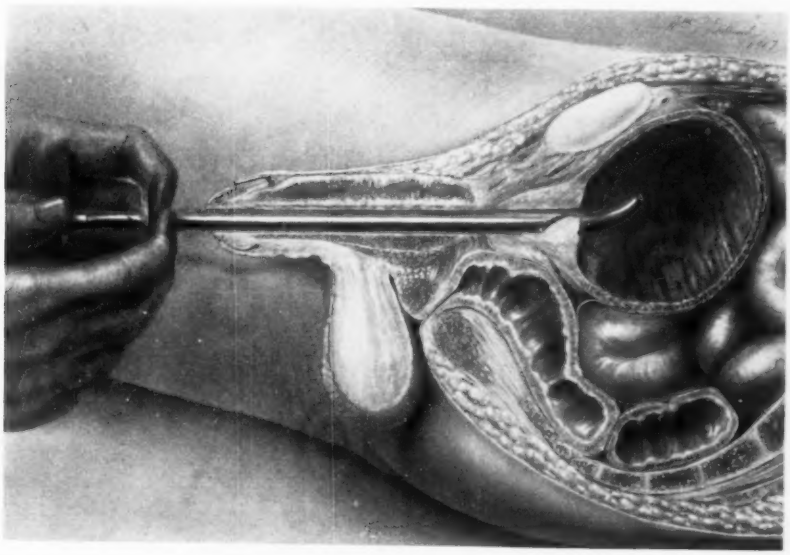

FIG. 7.—Instrument withdrawn until the median bar is entrapped in the fenestra, when the inner cutting tube is quickly pushed inward to excise the bar.

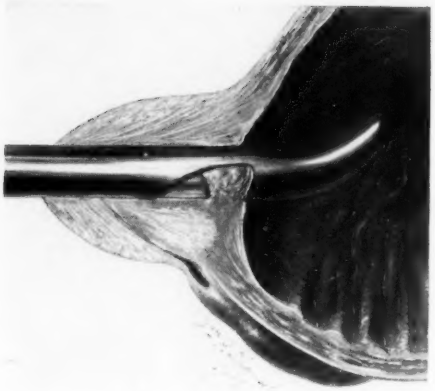

FIG. 8.—Cutting tube half way through median bar.

FIG. 9.—Cutting tube pushed home, completely excising bar.

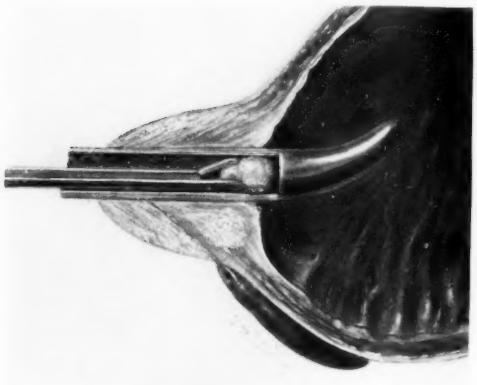

FIG. 10.—The excised bar grasped in tube with intra-urethral forceps previous to removal.

FIG. 11.—Result after excision of bar.

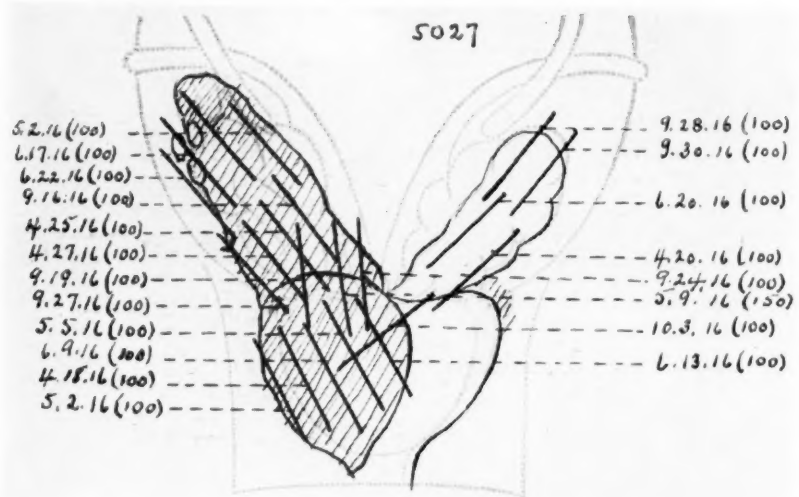


FIG. 12.—Chart of rectal treatments given in a case of carcinoma of the prostate and vesicle.

FIG. 13.—Chart showing the transvesical and transurethral treatments given in case illustrated in Fig. 12.

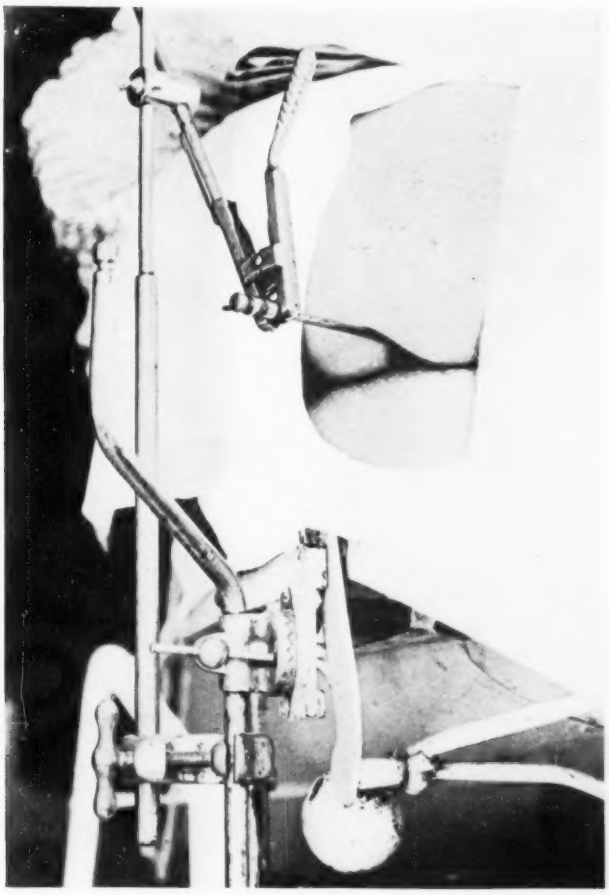

FIG. 14.—Showing rectal treatments, radium held against prostate by retaining clamp. (Patient lying on left side.)

The prostate is found to be about normal in size on rectal examination, and the cystoscope shows that the obstruction present is entirely at the vesical orifice, consisting of a small lobule which is directed anteriorly and to the right, and a fairly broad median lobe—the lateral lobes not being enlarged now. With finger in rectum and cystoscope in urethra the median portion is moderately increased in thickness and there is a firm collar around the shaft of the cystoscope at the vesical neck which is easily palpable.

*Deductions.*—It seems probable that a *punch operation* would remove this obstruction at the vesical orifice and be sufficient to restore normal urination. Plans are accordingly to be made to carry this out.

These were delayed by an acute "cold" accompanied by renewed cardiac disturbance.

*Operation* (March 13, 1916) (Young).—Novocaine 4 per cent. in posterior urethra, opium suppository in rectum, punch operation (Figs. 5–11), 8 cuts in all directions around prostatic orifice, commencing with an anterior cut in which a mass of tissue about 1 cm. in diameter was removed. The tissue masses removed by the lateral and posterior cuts were somewhat smaller, with the exception of the right anterior cut which apparently removed the lobule previously seen in that location with the cystoscope. There was very little hemorrhage—the clots were easily evacuated with a syringe through a large catheter which was fastened in urethra.

March 14, 1916: Patient had very little shock from operation. There was very little post-operative bleeding,[2] and the heart action remained as good as before. *The catheter was removed in thirty hours, and in a short time urine was voided naturally.*

March 15, 1916: No reaction. Voiding urine freely in amounts from 100 to 300 c.c.

March 18, 1916: Continues to improve. Catheter not required. Patient walking about ward.

March 28, 1916: Now two weeks since operation. Convalescence has been remarkably smooth. No cardiac attacks. Has not required catheter since day after operation. *Is now voiding normally, as much as 400 c.c. at a time. General condition excellent. Patient discharged.*

June 15, 1916: Patient returns for observation. He reports continued improvement in every respect. Heart giving very little trouble. Retains urine four hours, voids large amounts each

[2] I now use a "kephalin" coated catheter and thus induce quick hæmostasis. See paper by H. L. Cecil, *J. A. M. A.*, ——, 1917.

time. Urination normal. Bladder apparently empties itself perfectly. Prostate about normal in size, but slightly indurated. Result excellent.

*Pathological Report.*—By Dr. Howard Cecil. Path. No. 2350. The tissue removed by the anterior cut is 1.2 cm. wide. It contains a small amount of glandular tissue. This section is marked 1. The left anterior cut is 1.5 by ¾ cm. This also contains glandular tissue and the section is marked 2. The left cut is about 0.5 cm. in diameter and this section is marked 3. The left posterior cut is 1.2 cm. by 0.5 cm. wide; it contains glandular structure and is marked 4. The posterior cut is 2 by 1 cm. in diameter; it contains what seem to be definite spheroids and is marked 5. The right posterior cut is 1.5 by 1 cm. and is marked 7. The right anterior cut is 2 by 1 cm., the largest of all of the cuts; it contains a fair amount of glandular tissue and is marked 8.

The entire mass shows a definite hypertrophy, but there does not seem to be such a marked amount of connective tissue, though it is fairly hard.

The sections are very similar in appearance and show the following changes: The tissue is extremely rich in epithelial tissue that has undergone a marked degeneration. The section stains a deep blue with hæmatoxylin. In the acini there are large colloid areas of degeneration. The acini themselves are greatly shrunken, the cells are irregular, generally large, but in places small. The stroma itself has been greatly changed; the cells are vacuolated and the protoplasm has practically all been destroyed. The spheroids here are represented by masses that are very much smaller than normal and definitely encapsulated. There is some epithelial tissue which has undergone a definite colloid change represented by poorly staining blue homogeneous material which, under high power, shows that there is a definite network within the colloid material.

*Remarks.*—The effects obtained by radium in this case have been duplicated now in several other cases at our clinic—a remarkable shrinking of the hypertrophied gland, with the peculiar tissue changes above described—but also without complete relief of obstruction, which generally has remained unchanged, so that radium alone is apparently not a cure for prostatic hypertrophy. The fact that the "punch" operation has been so eminently successful in removing the obstruction remaining after radium treatment at the vesical neck shows a wider use for this procedure which we have heretofore reserved for non-hypertrophic obstructions at the vesical orifice, bars, valves, contractures and congenital obstructions which form so large and troublesome a group of cases.

By means of specially devised instruments, to be used through the rectum, urethra and bladder (Figs. 12–14)—the latter with a cystoscope inside it—it has been possible to get really remarkable results in many cases of prostatic carcinoma—relief of obstruction to urina-

tion, disappearance of enlargement, pain and hæmaturia. But the field is too new and the cases too recent to be discussed here. Suffice it to say that in radium we undoubtedly have a therapeutic agent of great value in urology and with improved apparatus, larger amounts of the element (we expect in the future to use 600 mg.) and systematic study of a long series of cases, many brilliant results should be obtainable.

This report serves to show that with radium the hypertrophied prostate may be made to atrophy so that a minor operation will suffice to restore normal urination. The long duration of treatment, however, suggests that it be confined to cases with severe complicating conditions which preclude perineal prostatectomy, although the latter may be ranked as a benign operation, having a mortality now under 2 per cent.

# SIDELIGHTS ON PROSTATIC ABSCESS

By Joseph F. McCarthy, M.D.
of New York

While in the course of their evolution prostatic abscesses, as is well known, manifest themselves in a variety of ways, and although periprostatitis and other purulent processes adjacent to this structure are generally considered under this head, only such purulent conditions as have an integral relation to the gland proper will, in this communication, be considered.

With reference to origin, prostatic abscess is generally classified as intrafollicular or interstitial; with reference to location, as central, cortical or submucous. From the fact of its canalicular relation to the prostatic urethra, as well as the dominant rôle played by the gonococcus, and the frequency of spontaneous intra-urethral evacuation of its pus, it would appear that the principal point of origin of the great majority of such abscesses is not very remote from the deep urethra.

Although in its incipient stage single abscesses may be encountered, the multiple type is habitually the rule. Where apparently one large abscess exists, it commonly is multilocular. Occasionally the whole glandular substance may be destroyed, or a number of small discrete foci may group themselves peri-urethrally, leaving the bulk of the gland intact. When, however, suppurating prostatitis exists and there is formed a large abscess, it nearly always involves the lateral lobes.

The abscess, once formed tends to open externally into the urethra, rectum or perineum. The majority of prostatic abscesses that open spontaneously do so into the deep urethra (74 in 104 cases). This rupture may occur through a single opening of varying size, through multiple openings, or rupture in an explosive manner, leaving behind cribriform or labyrinthian orifices.

As types of these openings, Fig. 1 represents the punctate type of orifice caused by the spontaneous evacuation of a small submucous abscess, Fig. 2 illustrates the cribriform, and Fig. 3 the labyrinthian type.

On the subject of symptomatology much or little may be said. At first glance it seems rather a trite subject. Unfortunately, such is not the case. A prostatic abscess may divulge its presence promptly, following an antecedent acute Neisserian urethral infection. There is noted a disappearance of urethral discharge, sudden rise in temperature, prostration, lancinating pain, intense dysuria, increased frequency or

FIG. 1.—Submucous prostatic abscess; spontaneous evacuation through a punctate orifice.

FIG. 2.—Prostatic abscess; cribriform openings.

FIG. 3.—Prostatic abscess; labyrinthian type of openings.

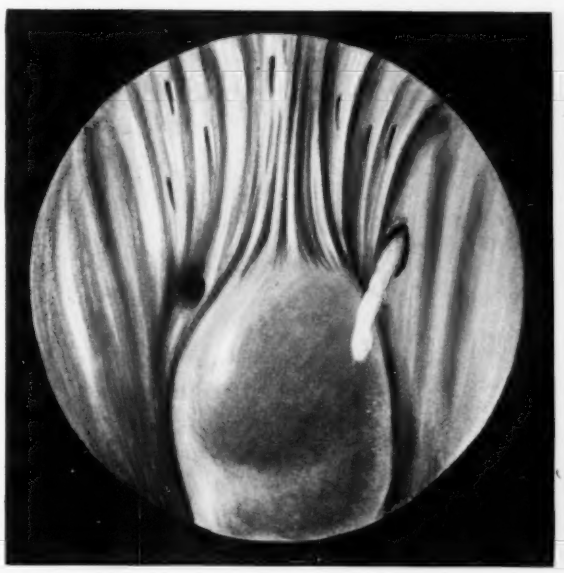

FIG. 4.—Latent submucosal forms of prostatic suppuration. Endoscopic appearance of orifice of discharge.

retention, constipation or painful defecation. Palpation reveals marked intrarectal tumefaction. Its existence may, on the other hand, be ascertained for the first time at the autopsy table. The first case of prostatic abscess that came under my observation occurred during an interneship at Bellevue Hospital in 1901. This patient had been operated for urethral stricture, and apparently underwent a normal convalescence. Shortly before his intended departure from the hospital, his chart showed certain temperature excursions. This condition grew worse, and the medical division was requested to go over the case. They diagnosed and treated it as typhoid. Autopsy revealed multiple foci of pus in the prostate gland.

Then there is a silent type of prostatic abscess that is recognized for the first time, somewhat to the astonishment and not a little to the discomfiture of the operator, in the course of a prostatectomy. Still another manifestation of this quiescent form is that described by Alexander. He stated that many cases of uncured posterior urethritis were in reality small discrete abscesses of the prostate. Finally, it has been my experience, and I feel sure that of other urologists with services in large public hospitals, to encounter cases that came to operation for acute or chronic urinary infiltration, as well as for apparent abscess of Cowper's gland, that were in reality old prostatic pus pockets. In many of these cases, there had evidently existed a silent abscess for an indeterminate period.

Though the above comprises merely a few of the manifold aspects of prostatic abscess, it is, I think, sufficient to make out a case for the assertion that the diagnosis of this condition, in many instances, is anything but an easy task.

Rarely is the history of a case as important as in this lesion. It therefore should be gone into most minutely. The reader will not be burdened with these details; they are to be had in any good textbook on the subject. There is, however, a sign-symptom-complex as follows, that may be regarded as pathognomonic. Given a case with an immediately antecedent history of acute Neisserian urethritis, with fairly profuse discharge, there supervenes a complete or almost complete disappearance of discharge, attended with retention, pain usually of a lancinating character, with or without temperature, with or without rigor, but with a large, diffuse, tender tumefaction elicited bimanually; there can be little question as to diagnosis.

In a suspected case of prostatic abscess in young subjects, the sign preëminent is acute retention. In this connection, an interesting corollary is to be noted. Observe that retention is an outstanding

feature of prostatic abscess. Associate this with the fact that sooner or later prostatic abscesses invade the lateral lobes. Would not this seem to emphasize the importance of intra-urethral lateral lobe encroachment in prostatic hypertrophy, as one of the chief factors in the chronic retention of prostatic enlargement?

As the reader has already noted, the preceding comments on diagnosis deal almost exclusively with the acute forms of the disease—such conditions as manifestly interdict the employment of diagnostic instruments. In the latent or chronic forms of discrete submucosal foci, early instrumental diagnosis, in conjunction with microscopic findings, should be the rule.

In fact with the instruments of precision as now manufactured in this country, in the hands of a reasonably expert instrumenteur, the diagnosis of many of these cases is simplicity itself. Fig. 4 illustrates one type of this class of cases.

On the subject of general prophylaxis and the abortive care of this condition, save for a few relatively unimportant details, there exists much harmony of view. Rest in bed, diet restriction, sedatives, heat to the symphysis and perineum, belladonna and opium suppositories, hot or cold rectal irrigations, etc., constitute the chief remedial agents. In this connection, I cannot subscribe to the use of rigid instruments designed to be introduced into the rectum in the presence of an acutely inflamed prostate. It is unquestionably better to employ two soft rubber tubes for this purpose—a No. 20–24 F. outflow tube provided with a terminal and a lateral eye; a 14 F. inflow tube with a single terminal eye. It should also be distinctly borne in mind that where an enema effect follows such rectal irrigations, the technic is faulty. Nature splints these parts for a definite purpose, which is defeated by three or four daily bowel movements.

When we come to consider the operative care of prostatic abscess, it is rather surprising to note the diversity of opinion as to the correct technical procedure. Practically all seem agreed upon one point—as soon as the diagnosis is made, open and drain. From here, however, surgical opinion radiates in all directions.

The representatives of the French school advocate the exposure of the prostate as in the Proust operation, vertical incision into the gland proper, and the breaking down with the finger of the various pus pockets. They do not advise drainage of the bladder. Others employ a median perineal incision, carried to and into the urethra. The finger is then introduced into this opening and laterally through the prostatic urethra into the abscess cavity. The cavity, as well as the

bladder, is drained in this operation. Quite recently, in this city, the suprapubic route has been advocated and to some extent practised.

It seems to the writer that next in importance to the evacuation and drainage of the pus, is the conservation of the urethra. If this be true, it follows that the median perineal incision or the suprapubic opening is faulty, the latter particularly so.

It might be asked if 74 in 104 cases opened *via* the urethra—what is the necessity for operation? A sufficient reason is the fact that 27 per cent. of these 74 cases subsequently developed more or less serious complications, possibly from faulty drainage. It, therefore, would appear that all large abscesses of the prostate should be opened surgically *via* the gland proper, regardless as to whether they have or have not opened spontaneously.

The procedure of choice, in the writer's opinion, is to immediately open a prostatic abscess by the perineal route, using the inverted V-incision. When both lobes are suspected make two vertical prostatic incisions deepened until the pus appears. Then, with the utmost gentleness of manipulation, open with the finger the various pockets. When one lobe is definitely involved, incise it thoroughly.

In the majority of cases it is a wise precaution to supplement drainage of the abscess cavity with perineal vesical drainage.

*To summarize:* The keynote of this brief communication is to make clear the fact that in the surgery of prostatic abscess, something more than evacuation of pus is required. A follow-up system will prove conclusively that many of these cases have recrudescences of their old urethritis; that unless they receive the most painstaking after-treatment, they carry foci of infection in the prostate gland that are a menace to the well-being of the individual particularly and to the community in general.

# NON-GONORRHŒAL AND NON-TUBERCULOUS EPIDIDYMITIS

By Irvin S. Koll, M.D.
of Chicago

This type of infection of the epididymis is now being recognized more frequently. Its frequency is much greater than was supposed. The conclusions drawn by the writer are taken from fourteen cases he has encountered in the past two years.

It is extremely difficult to assign a definite etiology to this variety of epididymal infection. In some instances no suggestion of a possible cause can be ascertained.

Trauma in various ways and degrees is evidently the factor most often accountable for the inflammatory and suppurating process that ensues. Direct blow upon the gland, squeezing of the scrotum between the legs when sitting down, were mentioned as causative in two of the cases. Instrumentation for urethral stricture was apparently accountable in three of the cases. In two instances there was direct extension from prostatospermatocystitis. In the remaining seven cases no possible predisposing factor could be determined.

When it is remembered that 20 per cent. of the male urethras harbor from fifteen to thirty different strains of bacteria which, though usually non-pathogenic, may become pathogenic under various stimuli, it is not to be wondered that these bacteria invade the ejaculatory ducts, vas deferens and epididymis.

In the fourteen cases cited, eleven were due to the staphylococcus, one to the streptococcus (Figs. 1 and 2), and two to the colon bacillus (Fig. 3). Thirteen were unilateral, all occurring on the left side; and one bilateral, not simultaneously however, for the right epididymis became involved several days following operation upon the left.

The histopathology, which is all-important in making a definite diagnosis, shows all the changes of a pyogenic infection. Depending upon the virulence of the invading bacteria, the changes vary in intensity and degree. Round-cell infiltration, miliary or large abscess formation. is the picture seen in the acute and subacute cases; marked fibrosis with complete disappearance of the tubules in the chronic type. The associated pathology concerns the testicle. In only one case the infection extended to this organ. This was a very virulent strepto-

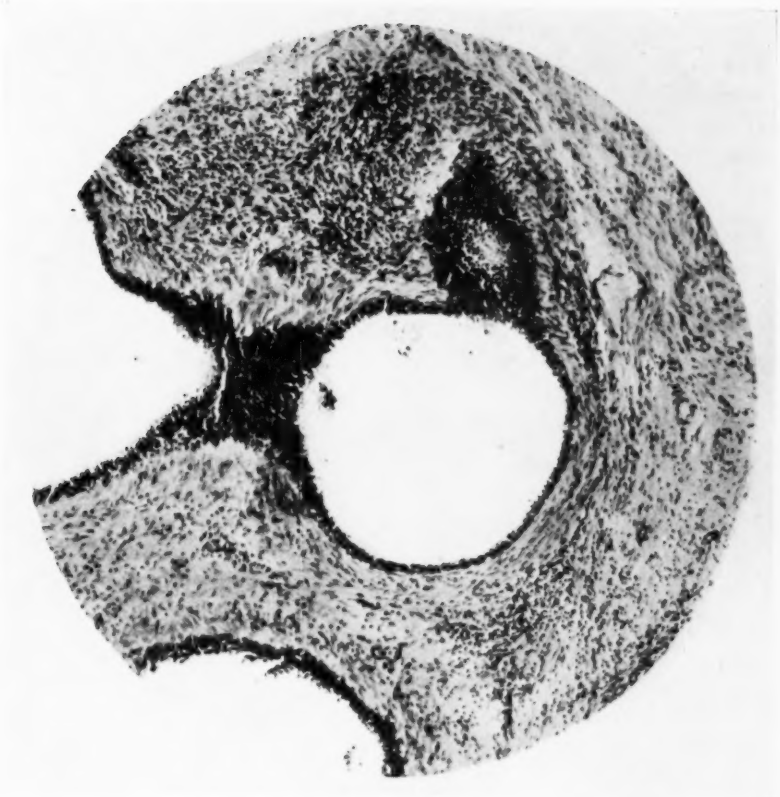

FIG. 1.—Acute streptococcic epididymitis, showing small abscess around a tubule.

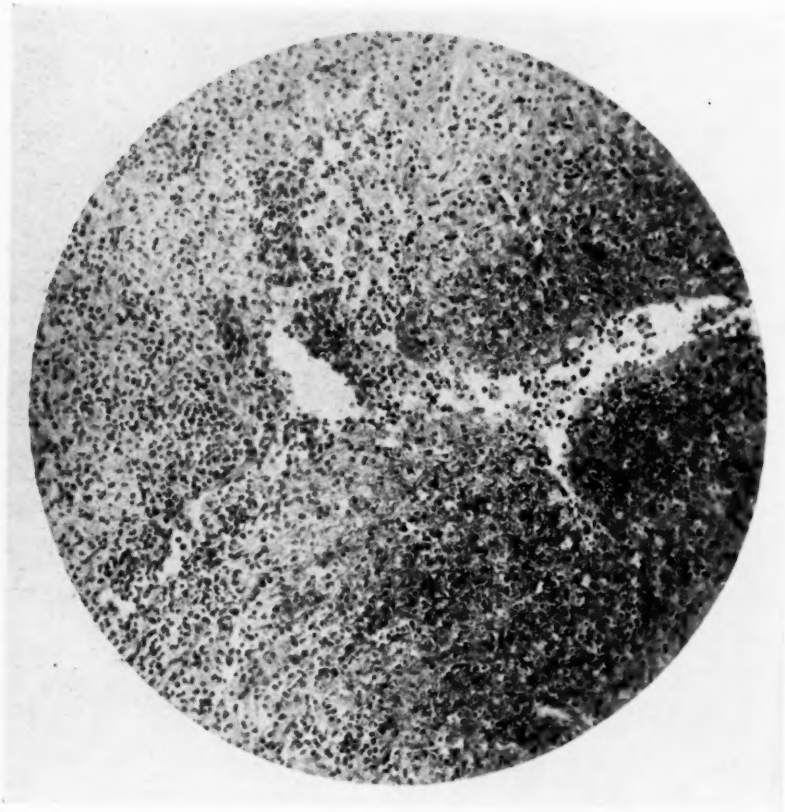

FIG. 2.—Acute staphylococcic epididymitis, showing large abscess.

FIG. 3.—Acute colon bacillus epididymitis.

FIG. 4.—Chronic fibrotic epididymitis, clinically identical with tuberculosis of the epididymis.

coccus invasion and also produced marked inflammation of the structures of the spermatic cord.

The clinical picture is either acute, subacute or chronic. The majority of the cases were chronic in their manifestation.

The acute onset is with severe pain along the spermatic cord and testicle. Exquisite tenderness promptly develops, the epididymis swells rapidly and the tunica vaginalis fills with exudate. The scrotum may become œdematous.

Symptoms of sepsis occurred several times. These were chills, temperature as high as 105° F., nausea and vomiting.

The condition may have to be differentiated from torsion of the cord.

The subacute variety is much less pronounced than its symptomatology. There is no systemic reaction. The pain, tenderness and swelling are promptly localized to the epididymis and are much less severe. The chronic type presents the greatest difficulty in diagnosis. Its onset and physical findings so closely resemble tuberculosis of the epididymis that it is utterly impossible to arrive at any final conclusion. To complicate this condition the prostate and the seminal vesicle on the same side may be enlarged and tender.

The treatment is unequivocally radical or operative. In the virulent infection action must be prompt or the testicle will be quickly invaded and destroyed.

There must also not be too much deliberation concerning the subacute and chronic forms for fear that the process may be tuberculous and extension occur. The production of sterility on the affected side must not enter into the consideration. In all probability the vas is no longer patent, and the ultimate results are far too important to delay. Epididymectomy should be promptly performed and histologic examination be made of the removed tissue. Many sections should be examined, preferably the entire epididymis sectioned when there will be no chance of error.

When due consideration is given the import of whether there is any tuberculous process or not the seriousness of the appeal for more care in diagnosing and managing these unusual epididymal infections will be realized.

# THE SURGICAL SIGNIFICANCE OF THE ESTIMATION OF THE NON-PROTEIN NITROGENOUS CONSTITUENTS OF BLOOD

WITH ESPECIAL REFERENCE TO THE PHENOLSULPHONEPHTHALEIN TEST: A PRELIMINARY REPORT

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The present contribution is essentially a brief, preliminary note on the comparative usefulness of the newer blood chemical methods in the estimation of *operative risk* from the standpoint of kidney function. The contribution which we shall present before the 1917 meeting of the American Urological Association will give all the data which have been obtained upon a series of urological surgical cases wherein a study of these non-protein nitrogenous constituents was made, together with the figures upon the phthalein output in these cases. Our aim is to show just what these tests will promise to the practical surgeon, *i.e.*, whether they give him any additional information over the routine and special urinary tests, whether they tend to disclose any hidden derangements in the kidney function that the physical examination fails to reveal and whether they finally differ in any particulars from the results obtainable with the Geraghty-Rowntree method of dye injection and elimination.

It might be well to review some of the known facts pertaining to the subject of non-protein nitrogenous metabolism. Without discussing the entire physiological and biological chemical phases of this question, we will content ourselves with a consideration of the chemistry of the three most important constituents, namely, uric acid, urea nitrogen and creatinine. The normal amount of total non-protein nitrogen per 100 c.c. of blood is 5 to 30 grammes; of urea nitrogen 12 to 15, of uric acid 1 to 3.0 and of creatinine 1 to 2.5. Urea comes from food (exogenous) derived from the nitrogenous portions of food, some of which is stored up as amino-acids, others being converted into ammonia and eliminated. Uric acid is partly endogenous and partly exogenous, about half and half. Its derivation from food can be traced from purin, a conversion into xanthin, and, finally, to uric acid, it being diaminoized before change to xanthin takes place. Creatinine is entirely endogenous in origin; it is constant hour by hour in blood and is not increased at all by protein food intake. It is also to be borne in mind that of these

three substances which represent the constituents which have been mainly studied with respect to retention and kidney efficiency, uric acid is the most difficult to eliminate its urea than its creatinine.

Studies upon nephritis, from very early to very advanced cases, have shown that the first substance to be retained is uric acid, next comes urea and finally creatinine. Myers and Chace have called attention to the so-called "stair-case" effect of this gradually increasing retention of the three constituents in the order named, dependent upon the severity of the nephritic process. It is in uræmic nephritis that we see the very highest concentration of these ingredients. It is to be emphasized here that the quantities of these ingredients in blood stand in no relationship at all to the presence of pathologically formed substances in urine such as albumin, casts or *urea*. So far as the last named *urinary* constituent is concerned, there is a very wide variation within physiological limits of the amount of urea present in urine, and therefore it is exceedingly difficult to draw conclusions as to kidney function from quantitative urinary urea estimations alone.

We assume that the cause of the severe symptoms in nephritis is impending or advancing uræmia and that the cause of the uræmia is resident in deficient elimination through kidneys. Whether the ingredients in blood which we are analyzing represent the substances themselves that produce the toxic symptoms or whether they are simply an index of the toxæmia, is of but little importance for the purpose in hand. We believe that we have in an analysis of this kind the surest method of determination by laboratory methods of deficiency in kidney function. Let us discuss for a moment the question of estimation of kidney function by means of the older methods, namely, phloridzin, indigo-carmine, cryoscopy and phenolsulphonephthalein. We are certain that practical surgeons and urologists have tried out all these methods and are willing to agree with us that they have in a large measure been found wanting. The estimation of kidney function by determination of the ease and speed with which a chemical dye can be eliminated through them seems somewhat rash, in theory and in practice. We shall confine our remarks more particularly to the functional test of Geraghty and Rowntree, for of all the color-producing substances that are used in kidney functional tests, it seems to be the most commonly used because of the ease of administration, the harmlessness of the procedure and the rapidity of making the test and obtaining the data required. Within certain limitations it gives a fairly good picture of kidney function, still it manifestly cannot give the observer the same intimate picture of metabolic processes and real

kidney efficiency or deficiency which goes with a complete blood chemical analysis. The work of Folin, Fitz, Frothingham and Denis, on "The Relation Between Non-Protein Nitrogen Retention and Phenolsulphonephthalein Excretion in Experimental Uranium Nephritis," gives a very good view of the exact value of each method of investigation from a purely experimental standpoint. These experiments showed that there was a wide difference in the figures of the phthalein test and the blood chemical data; that at the beginning of the nephritis, the phenolsulphonephthalein elimination dropped more rapidly than the accumulation of non-protein nitrogen and urea of the blood. During the course of the disease the height of the nitrogenous accumulation is reached from two to three days later than the lowest level of the phenolsulphonephthalein excretion. Non-protein nitrogen and urea accumulated in the blood and returned to normal gradually, in these rabbits, as recovery of the kidney occurred. These observers maintained that in general these two tests paralleled each other but with this essential difference; the amount of phenolsulphonephthalein excretion showed the kidney function at the moment; the amount of non-protein nitrogen and urea in the blood is rather a measure of an accumulating difference between the amounts of waste nitrogen produced in the metabolism and the amounts eliminated by the kidneys. The time element, the duration of the condition, constitutes therefore a most important factor in the comparison of these two tests. The phthalein test indicates the function for the *moment*, the blood chemical tests indicate the true *grade* of the working power of the kidneys. These experiments upon rabbits represent the earliest definite comparative tests of these two methods. The conclusions of Folin and his collaborators have been well borne out in practice. We know that there are many cases with little or no phthalein excretion that are badly deficient and would show high retention of these non-protein nitrogenous blood constituents; we know also that there are some cases with decreased phthalein output that are functionating quite well, viewed in the light of the non-retention of these ingredients of blood; we also know that there may be a normal phthalein output and a marked retention of the blood constituents.

These three sets of conditions would therefore make us pause in accepting alone the evidences of kidney function from the phthalein test alone. Our personal experiences with a comparison of the two methods have forced us to the conclusion that the estimation of kidney function in so far as it interests the surgeon cannot be intelligently viewed from the standpoint of operative risk without a survey of the

percentage of these blood constituents as well as the phthalein test. We have records showing extensive changes in kidneys without urinary change; without change in the phthalein output and yet with very definite retention of urea, uric acid and creatinine. We have other data showing that in the presence of a rather low phthalein output, kidney function may be unimpaired so far as retention of the non-protein nitrogenous constituents is concerned. The points which we wish to emphasize from our investigations with blood chemical methods as bearing upon the specialty of urological surgery do not vary much from the conclusions that interest the internists, namely, that the estimation of kidney function after all is entirely a matter of computation of a number of factors and that the phenolsulphonephthalein test occupies a subordinate position, even when positive, and then it is of much more importance than when negative. In other words, as recently pointed out by Beer, "The good excretion of test substances usually means good function. Occasionally hyperfunction, however, may accompany severe diseases and may be very misleading." Foster called attention to the high figures of phthalein output in persons dying with uræmia. Unfortunately, the investigators who have worked with these various methods have failed to make sufficiently searching researches upon all the important blood constituents which we are embracing in our present work. Beer's figures are based upon a comparison between phthalein and indigo-carmine, together with some excellent figures upon total nitrogen and urea nitrogen. He states nothing about uric acid or creatinine determinations, or upon sugar determinations.

We wish to emphasize the necessity of determination of the percentage of uric acid in early interstitial nephritis. As pointed out by Fine, possibly the earliest indication of interstitial nephritis is the retention of uric acid. We know that this retention of uric acid is characteristic of gouty conditions, of course, a retention that is of a permanent nature. Fine called attention to the similarity in the findings in gout and in early chronic interstitial nephritis. As the case progresses in severity, we find the urea nitrogen accumulating and lastly, in the extreme stages, we find an accumulation of creatinine. Creatinine accumulations, therefore, indicate severe kidney derangement of function. The striking fact first called to the attention of the profession by Myers, that a creatinine retention of 5 mgms. or over indicates a probable early fatal termination of the case, deserves special consideration at the hands of a surgical group. In Myers' experience, which we can verify by our own experiences in nephritis

and similar conditions, *no individual who has attained a figure of 5 mgms. or over of creatinine has ever recovered.* We have, therefore, in this one blood constituent a most important prognostic guide and one that should be earnestly investigated in our daily work. In one of our cases we found a very high degree of creatinine retention—over the fatal point—and a normal phthalein output. This case finally died of typical uræmia.

Our data have shown some results which will possibly surprise those who are still inclined to believe that the phthalein test is of service in estimating kidney function. We have some cases with mechanical obstruction to the outflow of urine, candidates for operation, with practically normal concentrations of uric acid, urea nitrogen, creatinine and sugar and yet with very low phthalein outputs. These cases according to our view in no way were in a state of disordered kidney function. We have one record of a case of marked stricture with no discoverable physical signs of kidney change, which showed high concentration of these ingredients, including creatinine, figures pointing to an impending uræmia, even though the clinical condition of the patient at the time of the first blood test was extremely good. Later on, true to the prediction of the blood findings, this patient lapsed into uræmia, and dissolution is now imminent, in fact, the patient will surely die before these records are in print. We will have completed in a short time a study of 50 cases of a surgical nature.

We have found that the results of urine analyses in no way compare in value with those of the blood chemical tests in indicating the status of renal function.

We do not wish to decry, for a moment, the carrying out of routine urinary analyses, nor do we wish to minimize the splendid helpfulness of a good urine analysis: rather, do we say that blood urine investigations should go hand in hand, but that the information obtainable from the blood chemical analysis, being of a different character, representing estimation of *retained* products of metabolism rather than the estimation of pathologically changed ingredients of a fluid such as a search for albumin or sugar in urine implies or the permeability through the kidneys of a dyestuff, gives a far better idea of metabolic changes and furnishes a superior basis for the diagnostic and prognostic valuation of a case to that furnished by the urine analyses. The blood chemical analysis tells us what the blood is storing up, what the kidneys are doing and what they are *not* doing, and also the exact status of nitrogenous and carbohydrate equilibrium. The urine analysis tells us a great deal about the pathology of the kidney function. One might be

described as an estimation of the organic changes in the kidneys; the other, the blood chemical analysis, is an estimation of the *minutiæ* of the renal function, from a pathological chemical and a pathological physiological viewpoint.

We must insist in emphatically denying that the estimation of the presence and percentage of albumin in urine and even the finding of casts indicate the condition of the kidney function from a surgical prognostic viewpoint. Kidney disease and kidney function are not synonymous by any means, as pointed out by others and confirmed by us.

In the summing up of the observations made by us of the results of routine and special urine analyses, phthalein test and blood chemical analyses, it can be concluded that the surgeon will be well repaid by utilizing the blood chemical methods in handling his cases, the general as well as urological surgical material being included under this heading. We have learned that the true condition of the renal function *cannot* be elicited by urine analyses alone. We have also learned that the phthalein test in estimating this function is not dependable. First, there may be high elimination of this dye by kidneys that are badly deficient. Second, kidneys may eliminate but little dye and yet their function is not disturbed sufficiently to contradict operative attack. Third, the rôle of the phthalein test is always subordinate to that of the blood chemical tests; therefore, the performance of this test, while interesting and partially corroborative, deserves but scant attention from a diagnostic and prognostic standpoint. It should never be taken at its face value when used alone, nor should it at all interfere with the judgment that is passed upon the operative candidate by the results of blood chemical methods. We are inclined to believe that the day is not far distant when these methods must be used in all operative departments of our hospitals, if we hope, in so far as human hands and minds can do so, to attain that millennium of lowest possible mortality for which surgeons are constantly striving.

With the use of these methods it is believed that many of the mishaps that are commonly ascribed to faults in surgical technic will be found to be due to insufficient knowledge of the manner of action of outwardly appearing intact kidneys and that, moreover, cases that urgently demand operative help will be given it, in spite of the apparently bad risks that they may appear to be, viewed in the light of albumin in urine, casts, low phthalein output—the true status having been obtained by blood chemical estimations.

# THE RESULTS OF OPERATIONS FOR TUMORS OF THE BREAST, BENIGN AND MALIGNANT*

By Paul Monroe Pilcher, M.D.
of Brooklyn, New York

## WITH CRITIQUE ON TECHNIC

By Lewis Stephen Pilcher, M.D.

There is still so great a degree of pessimism among physicians with regard to the cure of cancerous tumors of the breast, that a continuous scrutiny and frequent report should be made of the results which are secured by present methods of treatment in order that it may be determined to the satisfaction of everyone what definite advancement, if any, has been made in treating these lesions. The frequency of late malignant changes occurring in apparently benign tumors is another question of importance, closely allied with which is that of the later course in cases of such tumors which have been subjected to operative removal. It is with reference to their bearing on these various points that the results obtained during the first five years of work in our private hospital are presented in this paper.

*First,* with reference to the tumors and thickenings of the breast which are classified as chronic mastitis, and not infrequently are regarded as conditions in the precancerous stage, it is to be noted that the line of demarcation between the chronic inflammatory condition and a positive malignant state is so indistinct that no less an authority than MacCarty, of Rochester, Minnesota, makes the following significant statement after a most extensive study of the pathology of cancer of the breast: "Where to draw the line between the hyperplastic changes of chronic cystic mastitis and the pictures which are definitely carcinoma is beyond the writer's present power. There is no sharp line of demarcation. One condition merges into the other." In other words, a man who is accustomed to daily examinations of breast tumors, both before and after operation, including the section under

* This paper was completed by its author shortly before he was seized by the illness which terminated in his death on January 4, 1917. It is submitted for publication now both for its intrinsic scientific value, and as an example of the peculiar spirit in which he approached all surgical problems. It was his plan that it should be supplemented by a critical discussion by his father of the technic to be followed in operations for breast cancer, and at his urgent request the pages devoted to that subject were prepared. L. S. P.

the microscope, cannot tell in a given borderline case whether the disease is actually malignant or not.

If this is true from the standpoint of the microscopist it must be acknowledged that the difficulties which face the clinician are even more difficult, when he is called upon to differentiate between a cystic hyperplasia and an early malignancy. This is often true even when the breast tissue is exposed and gross section studied—for example, Fig. 1 is a diagram of a breast which presented different degrees of cytoplasia and deformity. The area *A* is hard and diffusely infiltrated. The area *C* is also diseased, but to a much less degree. Our impression on examination of this case is that we are dealing with a condition of chronic cystic degeneration of the breast, which at one point is changing to carcinoma. The breast is removed and the area *A*,

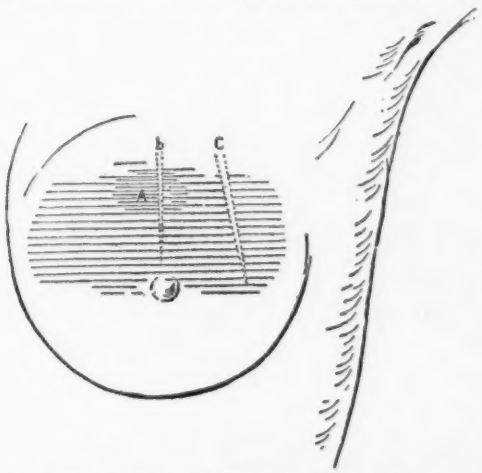


FIG. 1.—Diagram of breast showing areas of induration of indefinite nature with depressed tumor at *A*. Sections made at *b* and *C*.

Fig. 1, is cleared of its fat investment. The picture presented is shown in Fig. 2. Now we find a hard indurated area, with the centre depressed, and surrounded by evidences of advanced cystic hyperplasia. Incision through this area confirms our suspicion of an infiltrated mass extending down to the underlying fascia, Fig. 2, *b*. Then a section is made through the less indurated area at *C*, Fig. 1. This shows the typical gross picture of chronic cystic hyperplasia, as we are accustomed to see it (Fig. 3). In the gross then we have a typical case—first, cystic hyperplasia, and second the incidence of malignant degeneration. And yet the microscopic sections from all parts of this breast fail to show any evidence of tertiary cytoplasia, *i.e.*, lawless cell proliferation extending beyond the basement membrane. However, we know beyond reasonable doubt that if this patient was allowed to go

on without removal of this mass of hyperplastic breast tissue, she would die of cancer of the breast. On the other hand, if the entire breast is removed now, she can be assured of absolute freedom from cancer arising from that source. Basing an opinion on experiences gained in this class of cases, it seems logical *to recommend the removal of the diseased tissue in every case where a surgeon of experience cannot say with reasonable certainty that the case is one of non-progressive cystic or inflammatory induration.*

There are other deformities and lesions occurring within the breast which demand surgical care, about whose diagnosis great clinical difficulties are inevitable. For example, Figs. 4 and 5 are examples of extensive solitary cysts of the breast which have destroyed and replaced the breast tissue down to the fascia, and become attached to it. They are large, partly fixed tumors of the breast, causing marked deformity. Careful preoperative examination will often reveal the character of these tumors, and conservative surgery may be done. But unfortunately this is not always possible. The same is true of the unclassified tumors, encapsulated, and often extensively deforming, which are described as cystic fibro-adenomata and papillary cyst fibro-adenomata (Figs. 6 and 7). Clinically we cannot differentiate many of these tumors in the gross, and histologically the borderline is often most uncertain, so that even the most expert microscopist cannot tell us whether we are dealing with a malignant case or not. These facts justify the opinion of those surgeons who teach that if any case of chronic mastitis is operated upon in a woman over forty years of age, no partial resection of the breast should be done, but the entire breast should be removed. This, in fact, has been our own uniform practice in every case of chronic diffuse cystic mastitis.

Most surgeons can recall cases of suspected malignant growths in various parts of the body for which they have hesitated at first to recommend operation, and which they have consented at the request of the patient *to watch for a time.* Having forgotten the lesion for a while, when it is again brought to their attention, they have found it advanced to such a degree of unquestionable malignancy and diffusion that complete removal is no longer possible. Instances of this kind suggest the wisdom of the rule that exploration should be done in all cases of uncertain character. Such early exploratory operation has justified itself in many cases by bringing to early recognition cases in which malignant changes had already begun, and most surely has saved many a woman from death from cancer. For example, we have the records of two cases in point. Examination in one case revealed

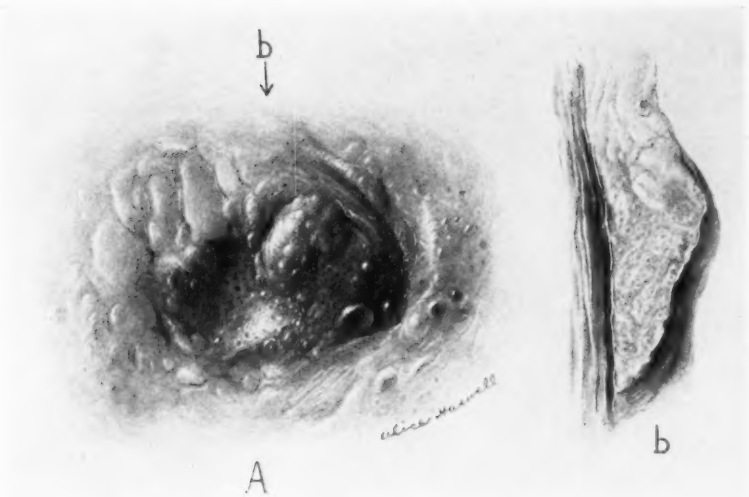


FIG. 2.—Gross appearance of tumor from Fig. 1, *A*, section made at *b*. Depressed contracted area noted in centre of specimen with evidences of cystic mastitis surrounding evident advanced cystic mastitis in a transitional stage. *b* is a section through indurated mass showing character of change.

FIG. 3.—Section through same breast (Fig. 1) at point *C*, showing difference in character of gross appearance in same breast. Gross appearance that of an earlier chronic cystic mastitis or primary cytoplasia of breast.

FIG. 4.—Non-malignant cyst of breast causing dense tumor deforming breast attached to underlying fascia easily mistaken for a hard tumor.

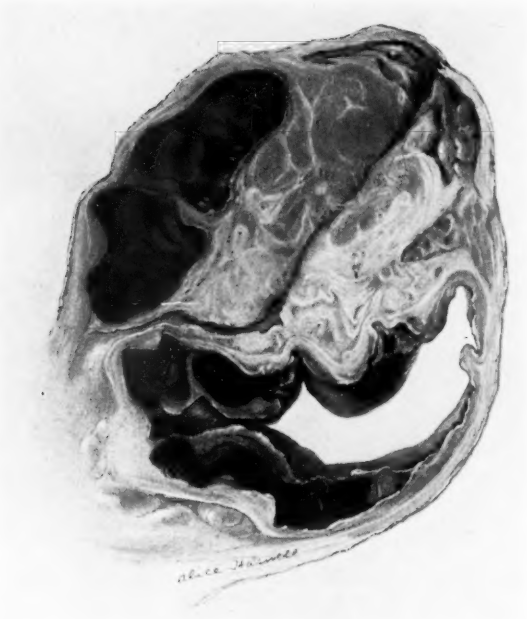

FIG. 5.—Section of large hemorrhagic cyst of breast destroying considerable tissue, causing deformity of breast and attached to underlying deep fascia.

FIG. 6.—Life size drawing of dense tumor of right breast in a woman 53 years of age. First noticed a lump six months ago situated in upper quadrant of breast. Freely movable and not in any way attached to the muscle. Glands in axilla and in supraclavicular space not unduly enlarged. Total removal of breast with muscles, dissection of axilla and dissection of supraclavicular space.

FIG. 7.—Cross-section of tumor seen in Fig. 6. Note, first, the retention cysts in the breast tissue; second, the perfectly encapsulated tumor and contents within the capsule: the various types of tissue—first, in the central portion a dense mass resembling an intracanalicular fibroma, divided from another piece of tissue on the left of the photograph by a fibrous capsule, then a papillomatous-like mass contained beneath the outer capsule, and on the right a series of cysts and one larger cyst which was quite independent of the other two masses.

FIG. 8.—Colloid cancer of breast. Small but rapidly spreading to glands. Very malignant.

FIG. 9.—Cancer of lacteal ducts presenting small nodule, retracting nipple. Only symptom continued hemorrhage.

FIG. 10.—Section of encapsulated fibroma of breast.

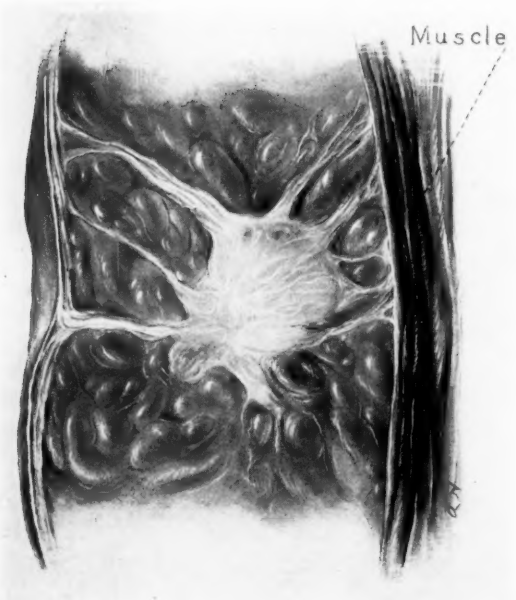


FIG. 11.—Cancer of breast deeply situated within a large breast. Examination showed a small, hard, movable tumor. On removal, under section showed a central lying cancer extending along the fascial planes of the skin and to the fascia over the deep muscle, requiring very extensive removal of the fascial planes.

a small nodule in the breast which to the fingers felt like a simple cyst, but when removed and sectioned proved to be a small colloid cancer (Fig. 8); a further dissection of the axillary and supraclavicular contents demonstrated the presence of cancer cells in the glands in both of these outlying districts. This patient remains well to date, after a period of over two years. The second case presented a small indurated area below a slightly retracted nipple (Fig. 9); after removal of the breast and axillary gland bearing tissues, the specimen was examined microscopically and proved to be a cancer involving the lacteal ducts. The patient is free from recurrence after a period of more than four years. Such examples could be multiplied in the experience of many surgeons, and they lead us to the conclusion that *more cases which should be operated upon, are refused early operation, on account of the conservatism of the surgeon, than there are cases operated upon by the surgeon in which operation was not required.* That is to say, our mistakes of omission are greater than those of commission.

Now, approaching the subject from this standpoint, we have recently reviewed the cases which have been treated in our private hospital since its opening seven years ago. Although relatively few in number, they have been thoroughly studied, and recorded and followed up. Those under care during the last two years are not included.

CLASS I.—*Non-malignant tumors.* During the first five years, therefore, of the operation of the hospital, fourteen cases of non-malignant tumors of the breast were operated upon. The cases included two fibromata (Fig. 10), one large cyst of the breast (Fig. 4), and eleven cases of secondary cytoplasia, including under this classification cases of chronic interstitial mastitis, chronic cystic mastitis (Figs. 1, 2, and 3), cystic fibro-adenomata and papillary cyst fibro-adenomata (Figs. 6 and 7), all names descriptive of the predominating pathological condition. In none of these cases could we discover by microscopical examination any actively growing nest of cancer cells. Of these fourteen cases *100 per cent. recovered from the operation, and 100 per cent. are well to-day (1916).*

CLASS II.—*Cancer.* The second class of cases consists of those of unquestioned cancer of the breast, with some axillary gland involvement, but the whole condition apparently still so localized that there seemed a reasonably good expectation of cure. In this class there were also fourteen cases. In all of these cases a complete operation was done, meaning, by the word complete, an operation in which not only the breast itself and the underlying pectoral muscles and a generous area of the overlying skin were removed, but also the fatty

and lymphatic tissues of the axilla were cleaned out. In addition to this, in some the supraclavicular triangle was also opened and freed of any possibly invaded tissue, and in some the fascia leading to the epigastric space was extensively removed. Of these cases all recovered from the operation; eleven are well and free from recurrence to-day; two cases have died of intrathoracic recurrence of the cancer; one patient died of apoplexy without any recurrence of the disease. In five of these cases it is now over five years since the original operation was done. In this class there were 100 per cent. recoveries from the operation with less than 15 per cent. deaths from recurrence.

CLASS III.—*Advanced cancer.* We have operated on eleven other cases all of which were in a very advanced stage of cancer, with extensive axillary involvement, often with supraclavicular extension, in which the operations were undertaken primarily for palliative reasons (Figs. 11, 12 and 13). In four of these cases there was some slight expectation of cure. Of these four cases one has remained well to date, a period of nearly four years. In her case the disease had already invaded both the axilla and the supraclavicular space at the time of operation.

RÉSUMÉ

| Non-malignant Tumors of Breast | | Mortality (Operative) | Permanent Cures Per cent. |
|---|---|---|---|
| Fibroma; chronic interstitial mastitis; chronic cystic mastitis; cyst fibro-adenoma (primary and secondary cytoplasia) | 14 | 0 | 100 |
| Cancer, early stages | 14 | 0 | 85 |
| Cancer, advanced stages | 11 | 0 | 9 |

Now as to the deductions to be made from such an experience, in which every effort was made to apply with every practicable fulness the precepts of the surgical teaching of to-day, the following statements are justified: In these 39 cases there has been no fatality from operation; every case operated upon in the precancerous stage is well and free from disease to-day; in all of the cases of cancer of the breast operated upon promptly as soon as the disease was discovered, there is an expectation of over 75 per cent. of permanent cures; in the very advanced cases there is only a slight expectation of cure, yet even in these cases many of the deformities and much of the suffering may be relieved by a prompt and extensive operation.

There are certain points in connection with cancer of the breast that cannot be too strongly emphasized and these are:

1. *In the early period in the development of every cancer of the breast it is absolutely curable.* If this fact were brought home to every woman, there would no longer be any deaths from cancer of the breast.

2. That, even a large and long active surgical experience does not qualify any man to say positively in many cases of chronic cystic mastitis (secondary cytoplasia) whether there is a malignant element present or not.

3. That in view of the immediate safety and later security from malignancy attending operation in doubtful or borderline cases every such case should have the benefit of surgery.

4. Recognizing the frequency with which the supraclavicular glands are invaded in tumors in the upper quadrants of the breast, every advanced case should have the benefit not only of axillary gland dissection, but also removal of the supraclavicular glands as a part of the primary operation.

5. That cases of recurrence, even where the opposite axilla or other breast becomes involved, are not necessarily fatal, for we have had three cases in which, although it has been necessary to remove both breasts and dissect out the lymphatic tissues from both axilla and both supraclavicular spaces, these patients are well and perfectly healthy to-day, over ten years after the first operation.

## REMARKS UPON TECHNIC

By Lewis Stephen Pilcher

In planning a technic for the removal of a breast carcinoma one must consider the different elements which have become recognized as essential to permanent success, viz.: (*a*) Complete removal of the primary focus of disease; (*b*) avoidance of carcinoma implantation upon the fresh tissue-surfaces exposed by the dissection; (*c*) the interruption of possible progressive metastasis by the routine removal of the first chain of lymph nodes which receive the absorbents from the area in which the primary focus lies; (*d*) the use of incisions in the primary steps of the operation that will facilitate the formation of plastic flaps that may be used to cover in the raw area remaining.

### A. COMPLETE REMOVAL OF THE PRIMARY FOCUS OF DISEASE

*The Axillary Lymph-nodes.*—Fifty years ago long-continued immunity from recurrence after an operation for carcinoma of the breast was exceedingly rare in the experience of surgeons even of the greatest

repute, and by many of large experience no permanent cures were claimed.[1]

The change which has taken place in the expectation of benefit from surgical interference in breast cancer, and which is exemplified in the results recorded in the first part of this paper, has been accomplished step by step since Dr. Chas. Moore, of the Middlesex Hospital of London, published, in 1867, his paper on "Inadequate Operations for Cancer."[2]

The importance of the removal of affected axillary lymphatic nodes insisted upon by the earlier writers—Moore, Banks, S. W. Gross—has developed into a complete routine removal *en masse* of the fatty node-containing tissue of the axilla from the apex to the base of this space, for besides the larger lymphatic nodes obvious to the naked eye on dissection, the axillary lymphatics present in their course innumerable tiny nodules of lymphoid tissue, each of which is a perfect lymphatic gland in miniature, and as such likely to be the earliest repository of infective material in transit through the lymphatics from the disease in the breast.[3] The systematic removal in all cases of all the gland-containing tissue of the axilla in an unbroken piece, continuous with the tissue containing the breast itself, is now recognized as a procedure of as much importance as the removal of the breast itself, as a part of the indication to be satisfied in securing the complete removal of the primary focus of the disease.

*The Pectoral Muscle.*—To the researches of a German observer—Heidenhain—published in 1889 (Heidenhain, "Über die Ursachen der localen Krebs-recidive nach amputatio mammæ," *Arch. f. klin. Chirg.*, 1889, p. 97) is due the demonstration of the early involvement of the underlying pectoral muscles in cases of cancer of the breast. Not until the publication of the convincing studies of Heidenhain had the full degree to which the carcinomatous process as a rule early extended to the subjacent pectoral muscles been appreciated by surgeons, nor had the importance of the routine removal of these muscles in a piece continuous with the affected breast been recognized. Figs. 11 and

[1] *Vid.* Halsted, ANNALS OF SURGERY, 1894, xx, 504; also Sir James Paget, Lectures on Surgical Pathology, 3rd Ed., p. 649: "I am not aware of a single clear instance of recovery; of such recovery, that is, as that the patient should live for more than ten years free from the disease, or with the disease stationary."

[2] Chas. Moore on "The Influence of Inadequate Operations on the Theory of Cancer," *Trans. Roy. Med. Chir. Soc.*, 1867, vol. 1, 245.

[3] Stiles, Contributions to the Surgical Anatomy of the Breast, Edin. Med. Journ., 1892.

FIG. 12.—Fungating cancer of the breast of long standing, extending down to the muscle fascia. Removed for palliative reasons only.

FIG. 13.—Carcinoma of breast and of glands of thorax and neck. Primary incision for exposing the structures of the supraclavicular region.

FIG. 14.—Excision of carcinoma of breast and glands of thorax and neck. (Same case shown in Fig. 13.) Cervical wound sutured. Raw surface exposed after removal of diseased structures, including both pectoral muscles, to be covered by Thiersch grafts.

12, made from growths removed at the Pilcher Hospital, show well the manner in which the muscle becomes involved. In the specimen from which Fig. 11 is drawn there is a small carcinomatous nodule situated in the centre of the mammary gland tissue. The diffusion of the process along the connective-tissue strands of the stroma to the muscle beneath is fully apparent, and their connection with the sheath and the substance of the subjacent muscle is unmistakable. In the specimen from which Fig. 12 was drawn the primary carcinomatous focus was more superficial, the skin was early involved and most of the development of the carcinoma has been externally as a fungating mass; the permeation of the carcinomatous process downward to the muscle is none the less evident. No question therefore, in our judgment, can now attend the dictum to include the removal of the pectoral muscles, major and minor, in a continuous piece with the breast as a part of the routine technic in all operations for carcinoma of the breast.

*The Skin.*—If the skin is manifestly involved in the carcinoma, its free ablation with the deeper disease has always been practised. A wider removal of the skin covering a diseased breast was one of the first steps adopted by those surgeons who essayed to make their operation for the breast cancer more thorough (Moore, S. W. Gross). The introduction of methods of covering large raw areas by epidermal strips by Thiersch encouraged surgeons to great liberality in skin removals (Figs. 13 and 14). In most women the possibility of obtaining flaps from the adjacent skin by suitably planned liberating incisions is so great that the covering of very extensive raw surfaces on the front of the thorax by such plastic flaps may be confidently relied upon. Various incisions planned to facilitate the forming of such plastic flaps have been advocated by various surgeons, and will be mentioned in more detail in a subsequent paragraph. It is a surgical maxim that even when the skin is not manifestly involved in a carcinomatous process in a breast, that portion of it which overlies the cancerous focus in the deeper tissue must be regarded with suspicion and practically should always be treated as if it were frankly involved, for it has been demonstrated that invasion of the finer lymphatics of the breast by cancerous elements from a cancerous nodule within its substance occurs early and extends widely, far beyond the manifest infiltrating edge of the primary growth, so whether the overlying skin appears involved in the cancer or not, a sufficient area of it must be removed with the growth to ensure that there be no possibility of any minute cancerous foci in the skin being left behind. On the other hand,

a very natural and proper reluctance will always be felt by a surgeon to remove an unnecessary amount of skin, especially if by so doing he subject the patient to a prolonged period of wound healing. In large tumors with extensively adherent skin, often ulcerated (see Figs. 13 and 14), the freedom with which the skin must be removed in order to carry the line of incision outside the probable area of infection must be so great that all idea of its plastic closure has to be abandoned. Even in such cases it will be found that by free undermining of the skin edges surrounding the raw area, and by raising plastic flaps by suitable outreaching incisions, a very considerable diminution may be secured of what may have seemed at first an appalling area of denudation, so that the amount of skin grafting finally required to cover it in may not be great. Of great importance in its bearing upon the question of the extent of skin removal has been the comparatively recent demonstration of Handley (" Cancer of the Breast and its Operative Treatment," 1906) that the tendency of cancer to spread centrifugally along the skin itself is quite insignificant, but that the important route for its spread is in the lymphatics of the deep fascia, from various points of arrest in which bourgeon outward those growths which involve the skin and form the recognizable nodules; if this teaching is correct, the undermining of the skin boundary and the larger removal of the underlying fascia becomes an important indication to satisfy in any operation. It should not be lost sight of by the surgeon at the time of the operation, especially since it is possible to satisfy it without adding to the difficulties of the later wound-healing. Such wider removal of the fascia will tend to reduce the frequency with which the surgeon, after even extensive skin removals, finds himself later confronted with cancer nodules developing in the skin of his flaps or possibly in still more distant regions (Fig. 15). Here lies also an additional advantage attending the removals *en bloc* of the axillary fat and lymph-nodes and the pectoral muscles, since there is necessarily involved in the dissection a wide extending removal of fascia. The removal of the deep fascia extending downward from the inner lower quadrant of the breast towards the epigastric region can be readily effected through a simple linear incision, by the retraction of the edges of which any desired area of the deep fascia can be exposed and removed without adding any difficulties to the closure of the main wound, but rather with the result of facilitating its accomplishment (Fig. 16). I agree with Handley that the necessary indications for the removal of skin can usually be fulfilled by the removal of a circular area of skin four to five inches in diameter centred upon the

growth, not upon the nipple. Such an area of skin is outlined by an ovoid incision with its narrowest diameter four inches or more, which is carried through the skin and the thin area of areolar fatty tissue just underneath, as the first step in the operation for the removal of a growth in a breast.

B. AVOIDANCE OF CARCINOMA IMPLANTATION UPON THE FRESH TISSUE SURFACES EXPOSED BY THE DISSECTION

More careful and intelligent attention to prevent cancer material from being sown in the wound while the primary growth is being removed is without question one of the important contributors to the great increase in the proportion of permanent cures that have followed operations for removal of cancer of the breast in recent years. Halsted, of Baltimore, in his epoch-making paper on "Operations for Cure of Cancer of the Breast" (ANNALS OF SURGERY, 1894, xx, 497), stated with emphasis that no incision should ever cut through cancerous tissues if it is possible to avoid doing so, saying: "that the wound might become infected with cancer either by the knife which had passed through diseased tissue, and perhaps carried everywhere the cancer-producing agents, or by the simple liberation of the cancer cells from their alveoli, or from the lymphatic vessels. The division of one lymphatic vessel and the liberation of one cell may be enough to start a new cancer. It is obvious that cancer-cell liberation and implantation may readily occur in the course of the operation when the section unintentionally goes through an unnoticed or unrecognizable minute tenuous proliferation of the disease which may have already extended in this degree to some distance away from the recognizable tumor along fascia or into muscle." The insistence by Halsted that skin and breast and axillary contents and pectoral muscles should be brought away in an unbroken mass was not the least important of the details of the operative technic followed by him, since by such a method only can the dangers of such cell implantation be reduced to a minimum. Since the publication of Halsted's paper in 1894, the removal *en bloc* of all the tissue under suspicion has become the rule among surgeons, and has been followed in all our own work.

C. THE ROUTINE REMOVAL OF THE FIRST CHAIN OF LYMPH-NODES, which receive the absorbents from the area in which the primary focus lies, has already been discussed in connection with the remarks upon the complete removal of the primary focus of disease. The axillary lymph-nodes form the first line of defense against early wide dissemination of the cancer cells taken up by the primary lymph radicles of the

breast. The lymph-nodes for a long time delay the progress of any cancer cells which reach them. Not only do they act as mechanical barriers, but for a time at least they exert a destructive action on cancer cells which reach them, and they only succumb to the invasion after a prolonged resistance (Handley, 52). Even after they have become frankly infected foci of cancerous proliferation they are slow to transmit cancer elements beyond their own substance; permeation of the carcinoma into the tissues surrounding them does not take place early, so that any operation which takes the whole chain out of the axilla before the adjacent tissues have become involved may be regarded with much certainty as having gone outside of the area of infection in that direction.

The *supraclavicular nodes* still remain debatable ground. As a rule they become infected much later than do the axillary nodes, and it is not rare for a breast cancer to progress to a fatal termination without any apparent involvement of the nodes above the clavicle. That in a very considerable proportion of cases they do become early infected is indubitable. In our own experience in numbers of instances it has happened to us to have patients present themselves with already manifest gross enlargement of the nodes above the clavicle, and in some instances recurrence after the removal of breast, pectoral muscles and axillary contents has first shown itself in the nodes above the clavicle. It has been demonstrated that the supraclavicular nodes often contain cancerous foci when to the naked eye they appear normal (Halsted). Their deep situation in the neck, covered over by the dense cervical fascia, makes it impossible to detect them by palpation through the skin until they have become materially enlarged by the progress of the carcinomatous process in them, which means at a comparatively late date when further permeation of the carcinoma beyond their borders may have already taken place. If the surgeon waits until they have become large enough to be detected by his finger tip applied to the overlying skin there is therefore greater possibility that the period during which their removal would be definitely efficient to remove all the disease will have passed. If the surgeon opens the base of the neck (Figs. 13 and 17), as he does the axilla, he will fail to find any indication that the supraclavicular nodes are involved in many of them, but on the other hand he will find in occasional instances diseased nodes which otherwise would have escaped detection and would have remained to defeat the most extensive and well carried out operation in other respects. To feel that one has done an unnecessary operation is never agreeable to any surgeon, and such would often be the

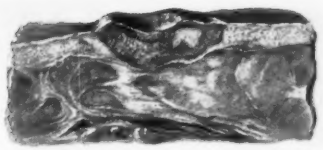

FIG. 15.—Recurrence of cancer in skin. Should be removed early.

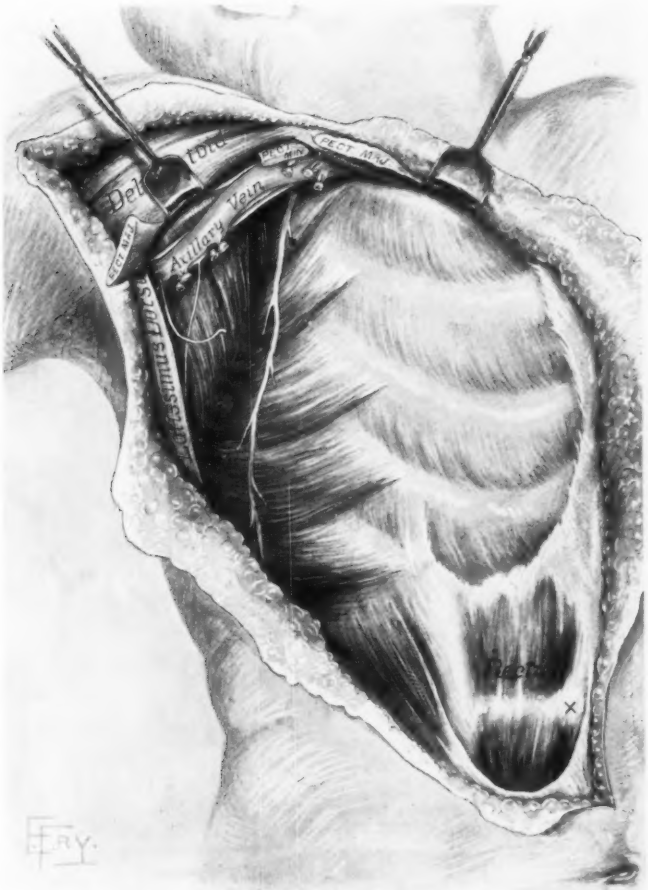


FIG. 16.—Showing the *area exposed at the completion of the recommended operation* for carcinoma of the breast. The axilla has been cleared; the pectoral muscles with overlying breast have been removed; the fascia covering the upper third of the rectus muscle has been taken off. The cross (×) marks the site of the weak epigastric spot.

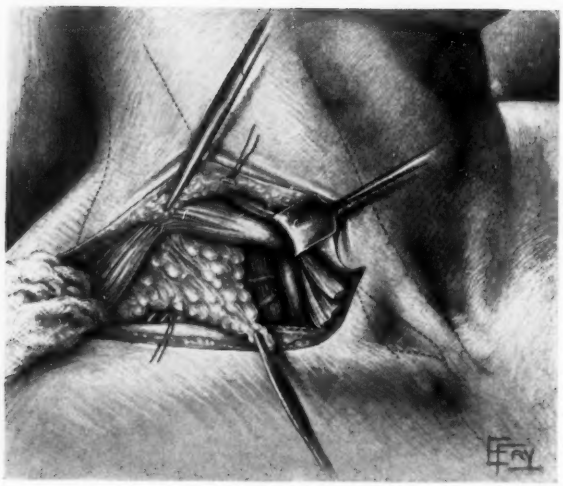

FIG. 17.—Dissection of *supraclavicular* gland-bearing tissue. This is done as the first step of the operation.

situation of the surgeon who opens the base of the neck in all cases; but to find in the future history of a case that one has omitted a most important and vital portion of surgical effort, a part which could readily have been done without adding materially to the risks of the operation, must be far more disagreeable.

As a guide to the surgeon in determining whether he shall clear out the supraclavicular space in a given case in which no gross evidence of infected nodes is apparent some help may be derived from a consideration of the paths along which infection may be carried to the supraclavicular nodes. If the more usual course is by permeation

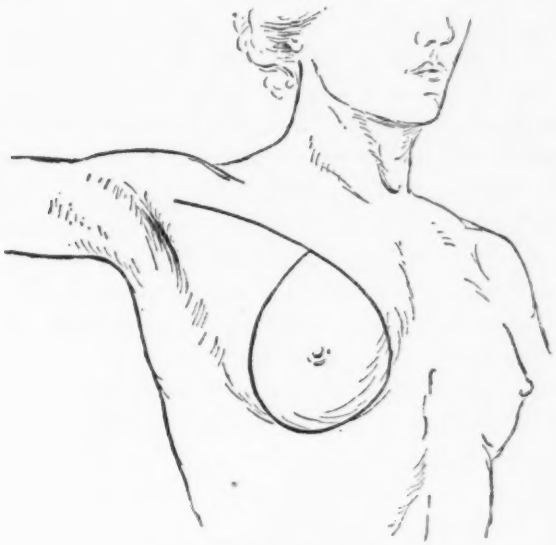

FIG. 18.—The Halsted incision.

along the efferent lymphatics which pass from the axillary to the supraclavicular nodes, then only when the upper nodes of the axillary chain together with the subclavian (Fig. 13) are much affected would one be led to suspect the transmission of infective material to the supraclavicular space. This would be an indication, without regard to the location or extent of the primary disease in the breast, that the supraclavicular space should be cleaned out (Fig. 17). If, however, the demonstration of the anatomists (Cuneo and Poirier) is accepted that there is in many cases, though not invariably, a set of lymphatics which share in the drainage of the upper half of the breast and pass upward in front of the clavicle to the deep-lying supraclavicular nodes, then in such cases these supraclavicular nodes will form a part of the

first line of defence against carcinomatous permeation equally with the axillary nodes and should be as a routine included in the tissues to be removed in all cases in which the primary focus of the carcinoma is in the middle or inner portions of the upper hemisphere of the breast. In the more advanced cases in which a great part of the whole mass of the breast has become involved, the indication to remove the supraclavicular nodes also develops. The state of the axillary and subclavian nodes is of importance from yet another point of view. The immediate effect of the conversion of a lymph-node into a carcinomatous mass is to block the lymph flow through it and to dam back the lymph and compel it to flow through other channels. Any considerable involvement of the axillary and subclavian nodes would of itself exaggerate the normal pressure upon the channels that lead up over the clavicle on the front of the thorax, and thus increase the possibilities of transfer of carcinoma already in the breast to the supraclavicular nodes direct. Hence the conclusion is logical, and the teaching is important that, whatever the location of the primary tumor, where the axillary and subclavian nodes have become so involved as to manifestly no longer be susceptible of freely transmitting the lymph stream, the supraclavicular nodes should be included in the tissues removed. The longer the duration of the axillary lymph-block, the more imperative the indication for exploring the base of the neck.

These considerations as to the relation of the supraclavicular nodes to the breast have governed us in our own work for many years, and the resulting technic has had its influence in securing the results now reported. The rules that guide us as to invading the supraclavicular space may be formulated as follows:

Regardless of whether or no enlarged nodes may be palpated above the clavicle, the supraclavicular space should be opened and its fat lymphatic tissues removed:

(*a*) Whenever the superior axillary and the subclavian group of lymph-nodes are infected to a pronounced degree.

(*b*) Whenever the primary focus of breast infection is in the upper hemisphere of the gland and well advanced in its development.

(*c*) Whenever the disease in the breast, whatever its primary location, has involved the upper hemisphere, and the growth is judged to be still operable.

*Primary Skin Incisions.*—While the amount of skin to be removed must in all cases comply with the principles already outlined in discussing the indications involved in complete removal of the primary focus, there are other considerations which the surgeon should take

into account in planning his skin incisions. He has further to consider in each case how he can secure the greatest freedom of access to all the tissues to be removed, and how he may with the most facility obtain the skin required to cover in the extensive raw area left by his dissection. He must not leave any dead spaces for the retention of secretions and he must furnish the axilla with such an adequate covering of skin that the movements of the arm shall not be seriously restricted when healing is completed, and the axillary scar must be in a position not exposed to friction and pressure. The original incision employed by Halsted (ANNALS OF SURGERY, 1894, xx, 528) is shown in Fig 18. It was planned to facilitate an operation in which the

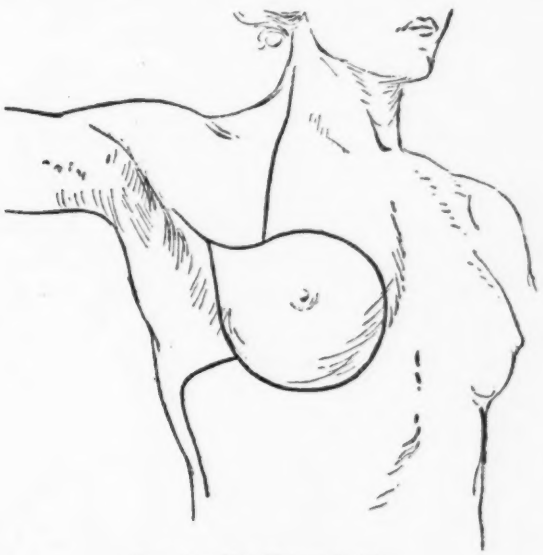

FIG. 19.—The Warren incision.

removal of the tissues from the front of the thorax was the first step and later the clearing out of the axilla. Exposure of the epigastric fascia was not planned for, and the formation of plastic skin flaps was not deemed important, because reliance was placed upon skin grafting to cover in such raw areas as were not readily covered by traction on the edges of the primary wound. Fig. 19 shows the additional lines of incision suggested by Warren (ANNALS OF SURGERY, 1904, xl, 827). The posterior incision curving backward and downward from the middle of the primary incision outlines a flap which later is raised and turned into the wound anteriorly. This posterior incision may be extended to any degree needed to form a flap of size sufficient to meet the needs of the wound to be covered in, provided the full thickness

of the vascular fatty superficial fascia layer is raised with the skin in making these flaps and care is taken to have wide bases of attachment that will supply nutrition to the whole of the flap, which must finally

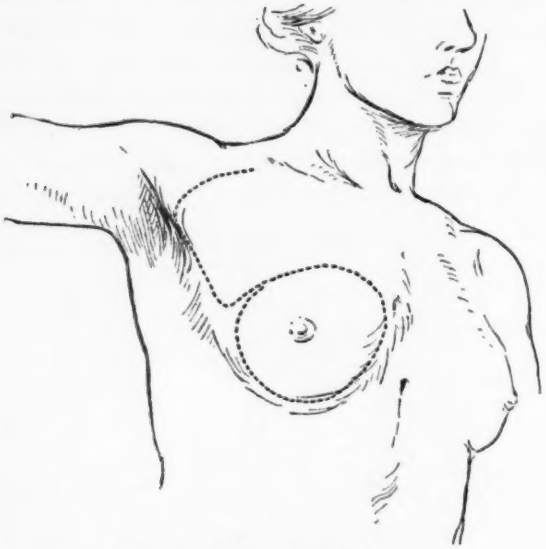

FIG. 20.—The Jackson incision.

FIG. 21.—The Rodman incision.

not be subjected to too great tension in approximating it to its place for suture. Jackson recommends procuring a flap from the anterior outer portion of the thorax and anterior axillary wall by an incision which is shown in Fig. 20 (Jackson, Reprint). It will be found a

convenient and valuable incision in many cases. It has the disadvantage of leaving the scar exposed on the anterior edge of the axilla. It may be resorted to with greatest facility in patients who present in the region involved a fairly loose and distensible skin. To it will have to be added other lines of flap formation in cases involving the lower hemisphere. There is no reason why the incisions of Warren and Jackson should not be used in the same case. In actual work the surgeon finds that peculiarities of the disease as to its extent and location, of the conformation of the individual, of the qualities of her tissues make of every patient a personal problem, often requiring great

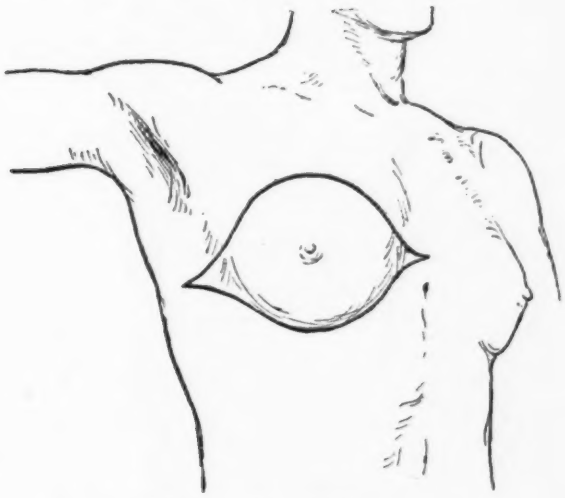

FIG. 22.—The Stewart incision.

ingenuity and skill, and full command of the resources of plastic surgery to secure for that patient the wound covering to be desired.

It is now the general practice among surgeons to complete the axillary dissection before proceeding to the removal of the tissues from the front of the thorax. By so doing the more important blood-vessels are divided at their point of origin, and the length of time during which the greater portion of the great wound is exposed uncovered is reduced to a minimum. The natural approach to the axilla is by a longitudinal prolongation outwards between the axillary folds of the incision circumscribing the breast. Various para-axillary incisions, more or less vertical to the axillary folds, have been proposed as a substitute for the more common longitudinal incision. Such is the vertical incision of Kocher and of Rodman (Fig. 21) (Pl. xliii,

A, Diseases of Breast, p. 298) and the transverse incision of Stewart (Fig. 22) (*Trans. Amer. Surg. Soc.*, 1915, p. 364). It is thought that the cicatrices of wounds in the axilla by their contraction are likely to limit the movements of the arm, or by their tenderness make the wearing of clothing and the free use of the parts painful. Œdema of the limb, with less reason, has been attributed to the axillary scar also. It is true that an exposed and contracted and tender scar, especially if

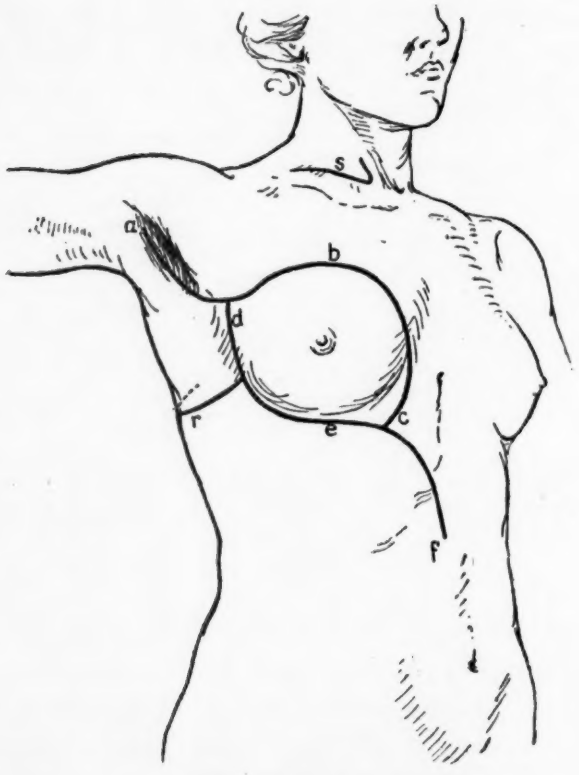


FIG. 23.—The Pilcher incision.

running along the anterior fold of the axilla or upon the front of the shoulder, deserves all that has been said against such scars, and they must be carefully avoided. To avoid them, however, it is not necessary to forego the advantages and convenience for the full exposure of the axilla and for having ready access to all its recesses which attach to a proper longitudinal incision. It is true that a para-axillary incision by reason of the relaxation of tissue produced by the extensive skin undermining, which is a part of the accepted technic, may be adequate for

sufficient access to the axilla in many cases, but to us they have seemed imperfect and unsatisfactory substitutes and we have not employed them. We, in common, as we believe, with most surgeons, use in the axilla a line of incision somewhat undulating, with its convexity approaching the posterior axillary fold (Fig. 23). This tends to construct a more generous axillary flap that becomes of special value later to cover in the axilla without tension when the final suture is being made. It ensures the full free extension of the arm, and as the line of suture falls into the concavity of the axillary space it is out of the way of the friction and pressure of clothing when active use of the arm is resumed. We confess to a distinct preference for the wide

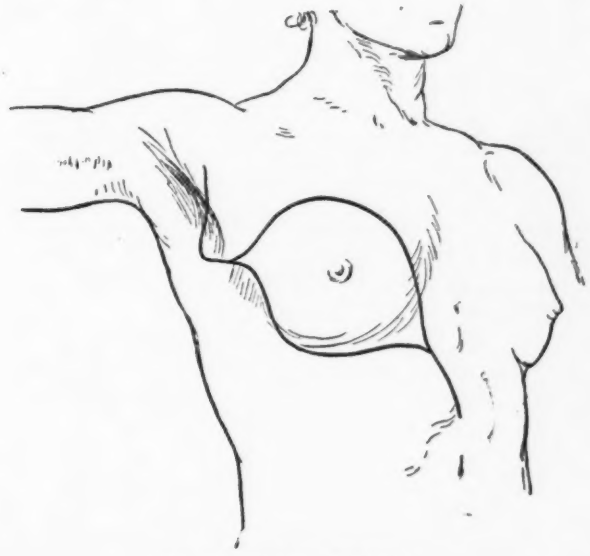

FIG. 24.—The Handley incision.

and unobstructed approach to such a region as the axilla which such an incision presents, and are persuaded that its advantages decidedly outweigh its possible disadvantages.

As this incision advances upon the front of the chest it sweeps upwards, reversing its curve; the distance above the nipple where it will be carried will depend upon the location and extent of the cancerous mass in the breast, observing the precautions and limitations which have been discussed in Section A. The inner end of the incision follows the margin of the breast on the sternal side where it joins with a lower incision which begins in the epigastrium and extends up to the inner margin of the breast, where it meets the upper incision, and

thence passes outwards around the lower border of the breast which it circumscribes until it meets the primary incision at the base of the axilla. A glance at Fig. 23 will show these incisions better than the fullest description. By such an incision it is possible to satisfy thoroughly and systematically all the indications presented in dealing with breast carcinoma, save the supraclavicular exposure for which a separate incision is best as shown in the Fig. 23, S. Fig. 16 shows the extensive area of axilla, thorax wall and epigastrium uncovered which such an incision makes possible. For its closure by suture it is possible to mobilize its borders by various liberating incisions, which will be determined by the judgment and ingenuity of the surgeon in each particular case.

A comparison of the lines adopted in our own work and those suggested by Handley (Fig. 24) will show that they are practically identical in their main features.

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